NPTEL Video Course - Computer Science and Engineering - Natural Language Processing

Subject Co-ordinator - Prof. Pushpak Bhattacharya

Co-ordinating Institute - IIT - Bombay

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction
Lecture 2 - Stages of NLP
Lecture 3 - Stages of NLP Continue...
Lecture 4 - Two approaches to NLP
Lecture 5 - Sequence Labelling and Noisy Channel
Lecture 6 - Noisy Channel
Lecture 7 - Argmax Based Computation
Lecture 8 - Noisy Channel Application to NLP
Lecture 9 - Brief on Probabilistic Parsing & Start of Part of Speech Tagging
Lecture 10 - Part of Speech Tagging
Lecture 11 - Part of Speech Tagging counted ...
Lecture 12 - Part of Speech Tagging counted ... and Indian Language in Focus; Morphology Analysis
Lecture 13 - PoS Tagging contd... , Indian Language Consideration; Accuracy Measure
Lecture 14 - PoS Tagging; Fundamental Principle; Why Challenging; accuracy
Lecture 15 - PoS Tagging; Accuracy Measurement; Word categories
Lecture 16 - AI and Probability; HMM
Lecture 17 - HMM
Lecture 18 - HMM, Viterbi, Forward Backward Algorithm
Lecture 19 - HMM, Viterbi, Forward Backward Algorithm (Continued...)
Lecture 20 - HMM, Forward Backward Algorithms, Baum Welch Algorithm
Lecture 21 - HMM, Forward Backward Algorithms, Baum Welch Algorithm (Continued...)
Lecture 22 - Natural Language Processing and Informational Retrieval
Lecture 23 - CLIA; IR Basics
Lecture 24 - IR Models
Lecture 25 - IR Models
Lecture 26 - NLP and IR
Lecture 27 - Least Square Method; Recap of PCA; Towards Latent Semantic Indexing (LSI)
Lecture 28 - PCA; SVD; Towards Latent Semantic Indexing (LSI)
Lecture 29 - Wordnet and Word Sense Disambiguation

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Lecture 30 - Wordnet and Word Sense Disambiguation (Continued...)
Lecture 31 - Wordnet; Metonymy and Word Sense Disambiguation
Lecture 32 - Word Sense Disambiguation
Lecture 33 - Word Sense Disambiguation; Overlap Based Method; Supervised Method
Lecture 34 - Word Sense Disambiguation
Lecture 35 - Word Sense Disambiguation
Lecture 36 - Resource Constrained WSD; Parsing
Lecture 37 - Parsing
Lecture 38 - Parsing Algorithm
Lecture 39 - Parsing Ambiguous Sentences; Probabilistic Parsing
Lecture 40 - Probabilistic Parsing Algorithms
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NPTEL Video Course - Computer Science and Engineering - Design and Analysis of Algorithms

Subject Co-ordinator - Prof. Sundar Viswanathan, Prof. Ajit A Diwan, Prof. Abhiram G Ranade

Co-ordinating Institute - IIT - Bombay

Sub-Titles - Available / Unavailable │ MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Overview of the course
Lecture 2 - Framework for Algorithms Analysis
Lecture 3 - Algorithms Analysis Framework - II
Lecture 4 - Asymptotic Notations
Lecture 5 - Algorithm Design Techniques
Lecture 6 - Divide And Conquer - I
Lecture 7 - Divide And Conquer - II Median Finding
Lecture 8 - Divide And Conquer - III Surfing Lower Bounds
Lecture 9 - Divide And Conquer - IV Closest Pair
Lecture 10 - Greedy Algorithms - I
Lecture 11 - Greedy Algorithms - II
Lecture 12 - Greedy Algorithms - III
Lecture 13 - Greedy Algorithms - IV
Lecture 14 - Pattern Matching - I
Lecture 15 - Pattern Matching - II
Lecture 16 - Combinational Search and Optimization - I
Lecture 17 - Combinational Search and Optimization - II
Lecture 18 - Dynamic Programming
Lecture 19 - Longest Common Subsequences
Lecture 20 - Matrix Chain Multiplication
Lecture 21 - Scheduling with Startup and Holding Costs
Lecture 22 - Average case Analysis of Quicksort
Lecture 23 - Bipartite Maximum Matching
Lecture 24 - Lower Bounds for Sorting
Lecture 25 - Element Distinctness Lower Bounds
Lecture 26 - NP-Completeness - I - Motivation
Lecture 27 - NP-Completeness - II
Lecture 28 - NP-Completeness - III
Lecture 29 - NP-Completeness - IV

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Lecture 30 - NP-Completeness - V
Lecture 31 - NP-Completeness - VI
Lecture 32 - Approximation Algorithms
Lecture 33 - Approximation Algorithms
Lecture 34 - Approximation Algorithms for NP
```

NPTEL Video Course - Computer Science and Engineering - Software Engineering

Subject Co-ordinator - Prof. N.L. Sarda, Prof. Umesh Bellur, Prof. Rushikesh K Joshi

Co-ordinating Institute - IIT - Bombay

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to Software Engineering - Challenges
Lecture 2 - Introduction to Software Engineering
Lecture 3 - Overview of Phases
Lecture 4 - Overview of Phases
Lecture 5 - Requirements Engineering / Specification
Lecture 6 - Formal Specification
Lecture 7 - Algebraic Specification Methods
Lecture 8 - Systems Modeling Overview
Lecture 9 - Process Modeling - DFD , Function Decomp
Lecture 10 - Process Modeling - DFD, Function Decomp
Lecture 11 - Data Modeling - ER Diagrams, Mapping
Lecture 12 - Data Modeling - ER Diagrams, Mapping
Lecture 13 - Production Quality Software - Introduction
Lecture 14 - Software Design - Primary Consideration
Lecture 15 - Design Patterns
Lecture 16 - Class and Component Level Design
Lecture 17 - Architectural Design
Lecture 18 - Software Testing - I
Lecture 19 - Software Testing - II
Lecture 20 - Structural Programming and Some implementation
Lecture 21 - Software Metrics and Quality
Lecture 22 - Verification and Validation
Lecture 23 - Case Study
Lecture 24 - Case Study
Lecture 25 - Software Evolution
Lecture 26 - Agile Development
Lecture 27 - Software Reuse CBSE
Lecture 28 - Reuse Continued
Lecture 29 - Introduction to Project Management

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Lecture 30 - Project Scope Management
Lecture 31 - Project Time Management
Lecture 32 - Estimation - I
Lecture 33 - Estimation - II
Lecture 34 - Project Quality Management
Lecture 35 - Quality Management Systems - I
Lecture 36 - Quality Management Systems
Lecture 37 - Project Configuration Management
Lecture 38 - Project Risk Management
Lecture 39 - Other PM Processes
```

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NPTEL Video Course - Computer Science and Engineering - NOC:Software Testing (2017)

Subject Co-ordinator - Prof. Meenakshi D'souza

Co-ordinating Institute - IIT - Bombay

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Motivation
Lecture 2 - Terminologies
Lecture 3 - Testing based on Models and Criteria
Lecture 4 - Automation - JUnit as an example
Lecture 5 - Basics of Graphs
Lecture 6 - Structural Graph Coverage Criteria
Lecture 7 - Elementary Graph Algorithms - Part 1
Lecture 8 - Elementary Graph Algorithms - Part 2
Lecture 9 - Algorithms
Lecture 10 - Assignment 2
Lecture 11 - Data Flow Graphs
Lecture 12 - Algorithms
Lecture 13 - Graph Coverage Criteria
Lecture 14 - Testing Source Code
Lecture 15 - Data Flow Graph Coverage Criteria
Lecture 16 - Software Design and Integration Testing
Lecture 17 - Design Integration Testing and Graph Coverage
Lecture 18 - Specification Testing and Graph Coverage
Lecture 19 - Graph Coverage and Finite state Machines
Lecture 20 - Assignment 4
Lecture 21 - Logic
Lecture 22 - Logic
Lecture 23 - Coverage Criteria, (Continued...)
Lecture 24 - Logic Coverage Criteria
Lecture 25 - Logic Coverage Criteria
Lecture 26 - Logic Coverage Criteria
Lecture 27 - Logic Coverage Criteria
Lecture 28 - Logic Coverage Criteria
Lecture 29 - Logic Coverage Criteria

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Lecture 30 - Week 6 Assignment Solving
Lecture 31 - Functional Testing
Lecture 32 - Input Space Partitioning
Lecture 33 - Input Space Partitioning
Lecture 34 - Input Space Partitioning Coverage Criteria
Lecture 35 - Syntax-Based Testing
Lecture 36 - Mutatioon Testing
Lecture 37 - Mutation Testing for Programs
Lecture 38 - Mutation Testing
Lecture 39 - Mutation Testing Vs. Graphs and Logic Based Testing
Lecture 40 - Assignment Solving for Week8
Lecture 41 - Mutation testing
Lecture 42 - Mutation Testing
Lecture 43 - Mutation testing
Lecture 44 - Software Testing Course
Lecture 45 - Testing of web Applications and Web Services
Lecture 46 - Testing of web Applications and Web Services
Lecture 47 - Testing of web Applications and Web Services
Lecture 48 - Testing of Object-Oriented Applications
Lecture 49 - Testing of Object-Oriented Applications
Lecture 50 - Symbolic Testing - 1
Lecture 51 - Symbolic Testing - 2
Lecture 52 - DART
Lecture 53 - DART
Lecture 54 - DART
Lecture 55 - Testing of Object-Oriented Applications
Lecture 56 - Testing of Mobile Applications
Lecture 57 - Non-Functional System Testing
Lecture 58 - Regression Testing
Lecture 59 - Assignment
Lecture 60 - Software Testing
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NPTEL Video Course - Computer Science and Engineering - NOC:Design and Pedagogy of the Introductory Programmi

Subject Co-ordinator - Prof. Abhiram G Ranade

Co-ordinating Institute - IIT - Bombay

Sub-Titles - Available / Unavailable │ MP3 Audio Lectures - Available / Unavailable


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Lecture 1 - Course Overview
Lecture 2 - Introduction and Survey.0
Lecture 3 - Introduction and Survey.1
Lecture 4 - Introduction and Survey.2
Lecture 5 - Basic Ideas in Our Approach.0
Lecture 6 - Basic Ideas in Our Approach.1
Lecture 7 - Basic Ideas in Our Approach.2
Lecture 8 - Basic Ideas in Our Approach.3
Lecture 9 - Basic Ideas in Our Approach.4
Lecture 10 - Basic Ideas in Our Approach.5
Lecture 11 - Basic Ideas in Our Approach.6
Lecture 12 - Pedagogy.0
Lecture 13 - Pedagogy.1
Lecture 14 - Pedagogy.2
Lecture 15 - Pedagogy.3
Lecture 16 - Pedagogy.4
Lecture 17 - Advanced Programming Topics.0
Lecture 18 - Advanced Programming Topics.1
Lecture 19 - Advanced Programming topics.2
Lecture 20 - In class questions, Assignments, Examinations.0
Lecture 21 - In class questions, Assignments, Examinations.1
Lecture 22 - Summing up
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NPTEL Video Course - Computer Science and Engineering - NOC:An Introduction to Programming through C++

Subject Co-ordinator - Prof. Abhiram G Ranade

Co-ordinating Institute - IIT - Bombay

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction - Part 1
Lecture 2 - Introduction - Part 2
Lecture 3 - Introduction - Part 3
Lecture 4 - Introduction - Part 4
Lecture 5 - Problem Solving using Computer - Part 1
Lecture 6 - Problem Solving using Computer - Part 2
Lecture 7 - Problem Solving using Computer - Part 3
Lecture 8 - Problem Solving using Computer - Part 4
Lecture 9 - Problem Solving using Computer - Part 5
Lecture 10 - Basic Elements of Program - Part 1
Lecture 11 - Basic Elements of Program - Part 2
Lecture 12 - Basic Elements of Program - Part 3
Lecture 13 - Basic Elements of Program - Part 4
Lecture 14 - Program Design - Part 1
Lecture 15 - Program Design - Part 2
Lecture 16 - Program Design - Part 3
Lecture 17 - Simple cpp Graphics
Lecture 18 - Conditional Execution - Part 1
Lecture 19 - Most general form of if - Part 2
Lecture 20 - More general form of conditions - Part 3
Lecture 21 - A somewhat large program example - Part 4
Lecture 22 - Switch statement and logical data - Part 5
Lecture 23 - Loops - Part 1
Lecture 24 - Mark averaging - Part 2
Lecture 25 - The break and continue statements - Part 3
Lecture 26 - The for statement - Part 4
Lecture 27 - Euclid's algorithm for GCD - Part 5
Lecture 28 - Correctness proof for GCD - Part 6
Lecture 29 - Computing Mathematical Functions - Part 1

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Lecture 30 - Computing Mathematical Functions - Part 2
Lecture 31 - Computing Mathematical Functions - Part 3
Lecture 32 - Computing Mathematical Functions - Part 4
Lecture 33 - Loops in various applications - Part 1
Lecture 34 - Loops in various applications - Part 2
Lecture 35 - Loops in various applications - Part 3
Lecture 36 - Loops in various applications - Part 4
Lecture 37 - Loops in various applications - Part 5
Lecture 38 - Functions - Part 1
Lecture 39 - Functions - Part 2
Lecture 40 - Functions - Part 3
Lecture 41 - Functions - Part 4
Lecture 42 - Functions - Part 5
Lecture 43 - Recursion - Part 1
Lecture 44 - Recursion - Part 2
Lecture 45 - Recursion - Part 3
Lecture 46 - Virahanka Numbers - Part 1
Lecture 47 - Virahanka Numbers - Part 2
Lecture 48 - Virahanka Numbers - Part 3
Lecture 49 - Program Organization and Functions - Part 1
Lecture 50 - Program Organization and Functions - Part 2
Lecture 51 - Program Organization and Functions - Part 3
Lecture 52 - Program Organization and Functions - Part 4
Lecture 53 - Advanced Features of Functions - Part 1
Lecture 54 - Advanced Features of Functions - Part 2
Lecture 55 - Advanced Features of Functions - Part 3
Lecture 56 - Advanced Features of Functions - Part 4
Lecture 57 - Array Part-1 - Part 1
Lecture 58 - Array Part-1 - Part 2
Lecture 59 - Array Part-1 - Part 3
Lecture 60 - Array Part-1 - Part 4
Lecture 61 - Array Part-1 - Part 5
Lecture 62 - Array Part-1 - Part 6
Lecture 63 - Array Part-1 - Part 7
Lecture 64 - Array Part-1 - Part 8
Lecture 65 - Array Part-1 - Part 9
Lecture 66 - Array Part-2 - Part 1
Lecture 67 - Array Part-2 - Part 2
Lecture 68 - Array Part-2 - Part 3
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Lecture 69 - Array Part-2 - Part 4
Lecture 70 - More on Arrays - Part 1
Lecture 71 - More on Arrays - Part 2
Lecture 72 - More on Arrays - Part 3
Lecture 73 - More on Arrays - Part 4
Lecture 74 - Arrays and recursion - Part 1
Lecture 75 - Arrays and recursion - Part 2
Lecture 76 - Arrays and recursion - Part 3
Lecture 77 - Arrays and recursion - Part 4
Lecture 78 - Arrays and recursion - Part 5
Lecture 79 - Structures - Part 1
Lecture 80 - Structures - Part 2
Lecture 81 - Structures - Part 3
Lecture 82 - Structures - Part 4
Lecture 83 - Structures Part 2 - Part 1
Lecture 84 - Structures Part 2 - Part 2
Lecture 85 - Structures Part 2 - Part 3
Lecture 86 - Classes - Part 1
Lecture 87 - Classes - Part 2
Lecture 88 - Classes - Part 3
Lecture 89 - Classes - Part 4
Lecture 90 - Classes - Part 5
Lecture 91 - Classes - Part 6
Lecture 92 - Representing variable length entities - Part 1
Lecture 93 - Representing variable length entities - Part 2
Lecture 94 - Representing variable length entities - Part 3
Lecture 95 - Representing variable length entities - Part 4
Lecture 96 - Representing variable length entities - Part 5
Lecture 97 - Representing variable length entities - Part 6
Lecture 98 - Representing variable length entities - Part 7
Lecture 99 - The Standard Library - Part 1
Lecture 100 - The Standard Library - Part 2
Lecture 101 - The Standard Library - Part 3
Lecture 102 - The Standard Library - Part 4
Lecture 103 - The Standard Library - Part 5
Lecture 104 - Data structure based programming - Part 1
Lecture 105 - Data structure based programming - Part 2
Lecture 106 - Data structure based programming - Part 3
Lecture 107 - Data structure based programming - Part 4
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Lecture 108 - Data structure based programming - Part 5
Lecture 109 - Medium size programs - Part 1
Lecture 110 - Medium size programs - Part 2
Lecture 111 - Medium size programs - Part 3
Lecture 112 - Medium size programs - Part 4
Lecture 113 - A graphical editor and solver for circuits - Part 1
Lecture 114 - A graphical editor and solver for circuits - Part 2
Lecture 115 - A graphical editor and solver for circuits - Part 3
Lecture 116 - A graphical editor and solver for circuits - Part 4
Lecture 117 - Cosmological simulation - Part 1
Lecture 118 - Cosmological simulation - Part 2
Lecture 119 - Cosmological simulation - Part 3
Lecture 120 - Cosmological simulation - Part 4
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NPTEL Video Course - Computer Science and Engineering - NOC:Demystifying Networking

Subject Co-ordinator - Prof.Sridhar Iyer

Co-ordinating Institute - IIT - Bombay

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction
Lecture 2 - Analogy for CEO's Problem
Lecture 3 - Discussing the CEO's Problem
Lecture 4 - From the CEO's Company to Layers in a Network
Lecture 5 - Layers in Detail
Lecture 6 - Layered Nature of a Network
Lecture 7 - Introduction to Internet Data Capturing using Wireshark
Lecture 8 - Network data captured while requesting a website
Lecture 9 - What is Cisco Packet Tracer
Lecture 10 - Modes of Cisco Packet Tracer
Lecture 11 - Getting Cisco Packet Tracer
Lecture 12 - Logical and Physical Typologies in Cisco Packet Tracer
Lecture 13 - Devices on Cisco Packet Tracer
Lecture 14 - Introduction to the Cisco Packet Tracer Activity for Week 1
Lecture 15 - Introduction to the campus network on Cisco Packet Tracer
Lecture 16 - Loading the page in Simulation Mode
Lecture 17 - Inspecting the packets in Simulation Mode
Lecture 18 - Editing the dummy website on Cisco Packet Tracer
Lecture 19 - Summary of the Cisco Packet Tracer Activity
Lecture 20 - Introduction to Anupam's Adventure
Lecture 21 - Anupam's adventure brings us to IP Addressing
Lecture 22 - Addressing at various layers
Lecture 23 - IP Addresses
Lecture 24 - Address Translation
Lecture 25 - Introduction to IP Addressing
Lecture 26 - Creating a network with Sub-net mask
Lecture 27 - Nomenclature of a sub-net mask
Lecture 28 - Network addresses and Private networks
Lecture 29 - Introduction to the Addressing Topology

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Lecture 30 - Addressing a local network and DHCP
Lecture 31 - Addressing a local network manually
Lecture 32 - Addressing in Pubilc and Private Networks
Lecture 33 - Verifying Connectivity using Ping
Lecture 34 - Using network address translation to communicate on internet
Lecture 35 - Using Sub nets and Summary of addressing
Lecture 36 - Summary of the week
Lecture 37 - Analogy for the week 2
Lecture 38 - Discussion on dabbawala analogy
Lecture 39 - From dabbawalas to routers and switches
Lecture 40 - What is routing ?
Lecture 41 - Static routing in a router in CPT
Lecture 42 - How does a switch forwards packets CPT
Lecture 43 - How to add static route in a router? (CPT)
Lecture 44 - Traveler's dilemma
Lecture 45 - Duscussing the Traveler's dilemma
Lecture 46 - From Traveler's dilemma to Dynamic Routing
Lecture 47 - Dynamic Routing with Distance Vector
Lecture 48 - Distance Vector Routing in Detail
Lecture 49 - Dynamic Routing with Link State
Lecture 50 - Setting up dynamic routing in Packet Tracer
Lecture 51 - Summary of the week
Lecture 52 - Introduction to analogy for week 3
Lecture 53 - Analogy for week 3
Lecture 54 - Questions on analogy for week 3
Lecture 55 - Understanding the new order requirements
Lecture 56 - Introduction to Tranport Layer
Lecture 57 - Introduction to TCP
Lecture 58 - Introduction to UDP
Lecture 59 - Exploring UDP on Cisco Packet Tracer
Lecture 60 - TCP Connection Establishment
Lecture 61 - TCP Connection Closure
Lecture 62 - Summay of TCP and UDP on Cisco Packet Tracer
Lecture 63 - The story of the delivery fiasco
Lecture 64 - From delivery fisaco to Port Numbers
Lecture 65 - Application Layer in depth
Lecture 66 - Port number in Wireshark
Lecture 67 - Summary of port number and PAT
Lecture 68 - Summary of the entire TCP IP stack
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Lecture 69 - Introducing the analogy for week 4
Lecture 70 - The secret box
Lecture 71 - Questions on analogy for week 4
Lecture 72 - Secret of the secret box
Lecture 73 - From secret box to encryption
Lecture 74 - Introduction to security and CIA
Lecture 75 - Information Security and Defence in Depth
Lecture 76 - Information Classification and Access Control
Lecture 77 - Process Management
Lecture 78 - Introduction to Network Security
Lecture 79 - Network Breach and Countermeasures
Lecture 80 - Internet Security
Lecture 81 - Securing the Internet Usage
Lecture 82 - Internet Security Products
Lecture 83 - Personal Computing Device Recommendations
Lecture 84 - Responsible Behavior on the Internet
Lecture 85 - Best practices for home Network and Media Devices
Lecture 86 - Closing thoughts on security
Lecture 87 - The story of a family trip
Lecture 88 - The troubleshooting approach
Lecture 89 - Troubleshooting Physical and Data Link Layers
Lecture 90 - Troubleshooting Network Layer
Lecture 91 - Troubleshooting Transport and Application Layers
Lecture 92 - Troubleshooting Summary
Lecture 93 - Troubleshooting Heuristics
Lecture 94 - Troubleshooting Challenge - 1
Lecture 95 - Troubleshooting challenge - 2
Lecture 96 - Troubleshooting Challenge - 3
Lecture 97 - Thats How we Troubleshoot
Lecture 98 - Week Summary
Lecture 99 - Course Closure
Lecture 100 - Course Credits
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NPTEL Video Course - Multi Disciplinary - NOC:Learning Analytics Tools

Subject Co-ordinator - Prof. Ramkumar Rajendran

Co-ordinating Institute - IIT - Bombay

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Intro to Data Analytics. What is Learning Analytics?
Lecture 2 - Academic Analytics, and Educational Data Mining
Lecture 3 - Four Levels of Analytics
Lecture 4 - Four Levels of Learning Analytics Overview - II
Lecture 5 - Data Collection from Different learning environment
Lecture 6 - Data collection in TELE
Lecture 7 - Data Preprocessing
Lecture 8 - Ethics in Learning Analytics, Student Privacy
Lecture 9 - Demo of Weka
Lecture 10 - Introduction to Machine Learning - Part 1
Lecture 11 - Introduction to Machine Learning - Part 2
Lecture 12 - Training and testing data
Lecture 13 - Performance Metrics - I
Lecture 14 - Performance Metrics - II
Lecture 15 - Performance Metrics - III
Lecture 16 - Demo of Orange
Lecture 17 - Descriptive Analytics - I
Lecture 18 - Descriptive Analytics - II
Lecture 19 - Charts - I
Lecture 20 - Charts - II
Lecture 21 - Charts - III
Lecture 22 - Comparing Charts
Lecture 23 - Descriptive Analytics â Example I
Lecture 24 - Descriptive Analytics â Example II
Lecture 25 - Excel tool
Lecture 26 - Diagnostics Analytics
Lecture 27 - Correlation
Lecture 28 - Correlation Matrix
Lecture 29 - Spearmanâ s Rank Correlation

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Lecture 30 - Data Mining
Lecture 31 - iSAT
Lecture 32 - Diagnostic Analytics - SPM
Lecture 33 - Sequential pattern mining (SPM-II)
Lecture 34 - Differential Sequence Mining (DSM)
Lecture 35 - Process Mining
Lecture 36 - Diagnostic Analytics - Clustering
Lecture 37 - K-means Clustering
Lecture 38 - Hierarchical Clustering
Lecture 39 - Clustering - Examples
Lecture 40 - Predictive Analytics
Lecture 41 - Linear Regression
Lecture 42 - Multiple Regression
Lecture 43 - Logistic Regression
Lecture 44 - Linear Regression - Example
Lecture 45 - Predictive Analytics - II
Lecture 46 - Naive Bayes Classifier
Lecture 47 - Decision Tree
Lecture 48 - Decision Tree Classifier
Lecture 49 - DT, NB - Examples
Lecture 50 - Text Analytics
Lecture 51 - Introduction to NLP
Lecture 52 - NLP-II
Lecture 53 - NLP-Tools
Lecture 54 - NLP-Examples
Lecture 55 - Intro Multimodal Learning Analytics
Lecture 56 - Affective Computing - 1
Lecture 57 - Affective Computing - 2
Lecture 58 - Eye Tracking
Lecture 59 - Revision of Learning Analytics tools course
Lecture 60 - Source of Data collection and Research Community
Lecture 61 - Machine Learning tools used in industry
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NPTEL Video Course - Computer Science and Engineering - NOC:Design and Engineering of Computer Systems

Subject Co-ordinator - Prof. Mythili Vutukuru

Co-ordinating Institute - IIT - Bombay

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to Computer Systems
Lecture 2 - Principles of Computer Systems Design
Lecture 3 - Overview of CPU hardware
Lecture 4 - Overview of memory and I/O hardware
Lecture 5 - Introduction to Operating Systems
Lecture 6 - Week 1: Tutorial 1
Lecture 7 - Week 1: Tutorial 2
Lecture 8 - Processes
Lecture 9 - Kernel mode execution
Lecture 10 - Threads
Lecture 11 - CPU scheduling policies
Lecture 12 - Virtual machines and containers
Lecture 13 - Week 2: Tutorial 1
Lecture 14 - Week 2: Tutorial 2
Lecture 15 - Week 2: Tutorial 3
Lecture 16 - Memory management in OS
Lecture 17 - Paging
Lecture 18 - Demand paging
Lecture 19 - File system and memory
Lecture 20 - Optimizing memory access
Lecture 21 - Week 3: Tutorial 1
Lecture 22 - Week 3: Tutorial 2
Lecture 23 - Week 3: Tutorial 3
Lecture 24 - Filesystem Datastructures
Lecture 25 - Filesystem Implementation
Lecture 26 - Network I/O via Sockets
Lecture 27 - Network I/O Implementation
Lecture 28 - Memory and I/O virtualization
Lecture 29 - Week 4: Tutorial 1

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Lecture 30 - Week 4: Tutorial 2
Lecture 31 - Introduction to computer networking
Lecture 32 - Internet Routing and Forwarding
Lecture 33 - Transport protocols
Lecture 34 - Application layer protocols
Lecture 35 - Network Security
Lecture 36 - Week 5: Tutorial 1
Lecture 37 - Week 5: Tutorial 2
Lecture 38 - Multithreaded application design
Lecture 39 - Inter-process communication
Lecture 40 - Multi-tier application design
Lecture 41 - Examples of end-to-end systems design
Lecture 42 - Deployment of computer systems
Lecture 43 - Week 6: Tutorial 1
Lecture 44 - Week 6: Tutorial 2
Lecture 45 - Performance measurement
Lecture 46 - Performance analysis
Lecture 47 - Performance profiling and optimization
Lecture 48 - Caching
Lecture 49 - Performance scalability
Lecture 50 - Week 7: Tutorial 1
Lecture 51 - Fault tolerance and reliability
Lecture 52 - Replication and consistency
Lecture 53 - Atomicity
Lecture 54 - Distributed transactions
Lecture 55 - Case studies of distributed systems design
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NPTEL Video Course - Computer Science and Engineering - NOC:Software Conceptual Design

Subject Co-ordinator - Prof. Sridhar Iyer, Prof. Prajish Prasad, Prof. T. G. Lakshmi

Co-ordinating Institute - IIT - Bombay

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1
Lecture 2
Lecture 3
Lecture 4
Lecture 5
Lecture 6
Lecture 7
Lecture 8
Lecture 9
Lecture 10
Lecture 11
Lecture 12
Lecture 13
Lecture 14
Lecture 15
Lecture 16
Lecture 17
Lecture 18
Lecture 19
Lecture 20
Lecture 21
Lecture 22
Lecture 23
Lecture 24
Lecture 25

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NPTEL Video Course - Computer Science and Engineering - NOC:Introduction to Game Theory and Mechanism Design

Subject Co-ordinator - Prof. Swaprava Nath

Co-ordinating Institute - IIT - Bombay

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction: Game Theory
Lecture 2 - Introduction: Mechanism Design
Lecture 3 - The game of chess
Lecture 4 - Proof of the chess theorem
Lecture 5 - Normal form games
Lecture 6 - Dominance
Lecture 7 - Nash equilibrium
Lecture 8 - Maxmin strategies
Lecture 9 - Elimination of dominated strategies
Lecture 10 - Preservation of PSNE
Lecture 11 - Matrix games
Lecture 12 - Relation between Maxmin and PSNE in matrix
Lecture 13 - Mixed strategies
Lecture 14 - Mixed strategy Nash equilibrium (MSNE)
Lecture 15 - Find MSNE
Lecture 16 - MSNE characterization theorem proof
Lecture 17 - Algorithm to find MSNE
Lecture 18 - Correlated equilibrium (CE)
Lecture 19 - Computing correlated equilibrium
Lecture 20 - Extensive form games
Lecture 21 - Subgame perfection
Lecture 22 - Limitations of SPNE
Lecture 23 - Imperfect Information Extensive Form Games (IIEFG)
Lecture 24 - Strategies in IIEFGs
Lecture 25 - Equivalence of Strategies in IIEFGs
Lecture 26 - Perfect Recall
Lecture 27 - Equilibrium in IIEFG
Lecture 28 - Game Theory in Practice: P2P file sharing
Lecture 29 - Bayesian Games

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Lecture 30 - Strategy, Utility in Bayesian Games
Lecture 31 - Equilibrium in Bayesian Games
Lecture 32 - Examples of Bayesian Equilibrium
Lecture 33 - Introduction to Mechanism Design
Lecture 34 - Revelation Principle
Lecture 35 - Introduction to Arrow's Impossibility Result
Lecture 36 - Proof of Arrow's Result
Lecture 37 - Introduction to the Social Choice Setup
Lecture 38 - Introduction to Gibbard-Satterthwaite Theorem
Lecture 39 - Proof of Gibbard-Satterthwaite Theorem
Lecture 40 - Domain Restriction
Lecture 41 - Median Voting Rule
Lecture 42 - Median Voter Theorem - Part 1
Lecture 43 - Median Voter Theorem - Part 2
Lecture 44 - The Task Sharing Domain
Lecture 45 - The Uniform Rule
Lecture 46 - Mechanism Design with Transfers
Lecture 47 - Examples of Quasi-linear Preferences
Lecture 48 - Pareto Optimality and Groves Payments
Lecture 49 - Introduction to VCG Mechanism
Lecture 50 - VCG in Combinatorial Allocations
Lecture 51 - Applications to Internet Advertising
Lecture 52 - Slot Allocation and Payments in Position
Lecture 53 - Pros and Cons of VCG Mechanism
Lecture 54 - Affine Maximizers
Lecture 55 - Single Object Allocation
Lecture 56 - Myerson's Lemma
Lecture 57 - Illustration of Myerson's Lemma
Lecture 58 - Optimal Mechanism Design
Lecture 59 - Single Agent Optimal Mechanism Design
Lecture 60 - Multiple Agent Optimal Mechanism Design
Lecture 61 - Examples of Optimal Mechanisms
Lecture 62 - Endnotes and Summary
```

NPTEL Video Course - Computer Science and Engineering - NOC:Introduction to Computer and Network Performance

Subject Co-ordinator - Prof. Varsha Apte

Co-ordinating Institute - IIT - Bombay

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction, why do delays happen, contention for resources
Lecture 2 - Performance metrics and parameters
Lecture 3 - Introducing Queuing Systems
Lecture 4 - Memoryless Distributions
Lecture 5 - Operational Laws
Lecture 6 - Asymptotic Analysis of G/G/1, G/G/1/K queues
Lecture 7 - Asymptotic Analysis of G/G/c/K queues
Lecture 8 - Little's Law
Lecture 9 - Littleâs Law examples and A Case Study of Open Load test on a Web server
Lecture 10 - Some results for M/G/1 queue and Memoryless Arrivals
Lecture 11 - Continuing the Case Study of Open Load test on a web server (Response Time)
Lecture 12 - Open queuing networks - tandem queuing network
Lecture 13 - Open queuing networks - general (Jackson) queuing networks
Lecture 14 - Open queuing networks - examples
Lecture 15 - Closed Queuing Systems
Lecture 16 - Closed Queuing System (Continued...)
Lecture 17 - Case study of Closed Load Test on a Web Server
Lecture 18 - General formulation of Jacksonian Closed Queuing Networks
Lecture 19 - Mean Value Analysis for Closed Queuing Networks
Lecture 20 - Mean Value Analysis examples,Case Study of a Load test on a web server,Closing Remarks

NPTEL Video Course - Computer Science and Engineering - NOC:Games and Information

Subject Co-ordinator - Prof. Ankur A. Kulkarni

Co-ordinating Institute - IIT - Bombay

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction, why do delays happen, contention for resources
Lecture 2 - Performance metrics and parameters
Lecture 3 - Introducing Queuing Systems
Lecture 4 - Memoryless Distributions
Lecture 5 - Operational Laws
Lecture 6 - Aumann model of incomplete information: Definition and Examples
Lecture 7 - Knowledge operator: Definition and Examples
Lecture 8 - Common knowledge: Definition and Examples
Lecture 9 - The structural theorem of common knowledge
Lecture 10 - Proof of the structural theorem (forward direction)
Lecture 11 - Proof of the structural theorem (backward direction)
Lecture 12 - Aumann model of incomplete information with belief: Definition and Examples
Lecture 13 - Aumann's agreement theorem
Lecture 14 - Zero-sum game definition and Security strategies
Lecture 15 - Saddle point strategies
Lecture 16 - Further properties of saddle point strategies
Lecture 17 - Mixed strategies
Lecture 18 - Weirstrass lemma and existence of a mixed saddle point strategy
Lecture 19 - Von Nuenmann minmax theorem
Lecture 20 - Computing mixed saddle point startegy: Holmes and Moriarty
Lecture 21 - Computing mixed strategy saddle point: 2X2 matrix game
Lecture 22 - Computing mixed strategy saddle point: 2X3 matrix game
Lecture 23 - Nash equilibrium of a non zero-sum game and its relation with Kakutani fixed
Lecture 24 - Proof: Existence of Nash equilibrium (Condition 1 of Kakutani fixed point)
Lecture 25 - Proof: Existence of Nash equilibrium (Condition 2 of Kakutani fixed point)
Lecture 26 - Existence of Nash equilibrium for infinite strategy space (Using Brower's)
Lecture 27 - Quantal Response: Motivation
Lecture 28 - Quantal Response: Formal model
Lecture 29 - Dynamic games definiton

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Lecture 30 - Solution concept in dynamic games
Lecture 31 - Relation of the heuristic solution with the Nash equilibrium of the standard
Lecture 32 - Example of a Threat equilibrium
Lecture 33 - Interpreting the threat equilibrium in standard normal form of the dynamic game
Lecture 34 - Extensive form games - I
Lecture 35 - Extensive form games - II
Lecture 36 - Single Act Games
Lecture 37 - Informationally inferior games
Lecture 38 - Information Structure in Single Act Games
Lecture 39 - Nested and Ladder Nested Extensive form games
Lecture 40 - Equilibrium Algorithm
Lecture 41 - Stage-wise multi act games
Lecture 42 - Feedback equilibrium
Lecture 43 - Mixed and Behavioral Strategies
Lecture 44 - Conditions for equivalence for mixed and behavioral strategies
Lecture 45 - Kuhn's Theorem - I
Lecture 46 - Kuhn's Theorem - II
Lecture 47 - Kuhn's Theorem - III
Lecture 48 - Games of incomplete information
Lecture 49 - Bayesian Nash equilibrium - I
Lecture 50 - Bayesian Nash equilibrium - II
Lecture 51 - Self-enforcement of Nash equilibrium
Lecture 52 - Stackelberg game
Lecture 53 - Principal-Agent Models - I
Lecture 54 - Principal-Agent Models - II
Lecture 55 - Moral Hazard and Adverse selection
Lecture 56 - Games with contracts
Lecture 57 - Correlated Equilibrium - I
Lecture 58 - Correlated Equilibrium - II
Lecture 59 - Correlated Equilibrium - III
Lecture 60 - Bayesian Game with mediated communication
Lecture 61 - Revelation Principle
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NPTEL Video Course - Computer Science and Engineering - NOC:Distributed Optimization and Machine Learning

Subject Co-ordinator - Prof. Mayank Baranwal

Co-ordinating Institute - IIT - Bombay

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to optimization
Lecture 2 - Analyzing optimization algorithms in continuous time domain
Lecture 3 - Course Outline
Lecture 4 - Basics of optimization problems
Lecture 5 - Convex sets and Convex functions
Lecture 6 - Strictly and strongly convex functions
Lecture 7 - Implications of strong convexity
Lecture 8 - Primal and dual optimization problems
Lecture 9 - Slaters condition
Lecture 10 - Analysis of gradient descent algorithm
Lecture 11 - KKT conditions
Lecture 12 - Acceleration under strong convexity
Lecture 13 - Accelerate the convergence even further
Lecture 14 - Stability theory
Lecture 15 - Connections to optimization problems
Lecture 16 - Exponential stability
Lecture 17 - Bregman Divergance
Lecture 18 - Rescaled Gradient Flow
Lecture 19 - Advanced Results on PL inequality - Part 1
Lecture 20 - Advanced Results on PL inequality - Part 2
Lecture 21 - Constrained Optimization Problem
Lecture 22 - Augmented Lagrangian
Lecture 23 - Method of Multipliers
Lecture 24 - Dual Ascent and Dual Decomposition
Lecture 25 - ADMM Algorithm
Lecture 26 - Basics of Graph Theory - 1
Lecture 27 - Basics of Graph Theory - 2
Lecture 28 - Consensus and Average Consensus - 1
Lecture 29 - Consensus and Average Consensus - 2

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Lecture 30 - Consensus Algorithms
Lecture 31 - Consensus Algorithms - Fixed time
Lecture 32 - Distributed Economic Dispatch Problem
Lecture 33 - Algorithm for Uncapacitated EDP
Lecture 34 - Capacitated EDP
Lecture 35 - Algorithms for Distributed Optimization - 1
Lecture 36 - Algorithms for Distributed Optimization - 2
Lecture 37 - Continuous-time Distributed Optimization Algorithms
Lecture 38 - Introduction to Neural Networks
Lecture 39 - Large Scale Machine Learning
Lecture 40 - Decentralized Stochastic Gradient Descent - 1
Lecture 41 - Decentralized Stochastic Gradient Descent - 2
Lecture 42 - Introduction to Federated Learning
Lecture 43 - FedAvg Algorithm
Lecture 44 - Convergence Analysis of FL
Lecture 45 - Sources of Computational Heterogenity in FL
Lecture 46 - Objective Inconsistency Problem
Lecture 47 - General Update Rule
```

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NPTEL Video Course - Computer Science and Engineering - NOC:Time Series Modelling and Forecasting with Applic

Subject Co-ordinator - Prof. Sudeep Bapat

Co-ordinating Institute - IIT - Bombay

Sub-Titles - Available / Unavailable │ MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Time series introduction
Lecture 2 - Examples of time series data
Lecture 3 - Stationarity in time series
Lecture 4 - Weak vs.strong stationarity
Lecture 5 - Practical session in R-1
Lecture 6 - Time Series Decomposition
Lecture 7 - Basic Time Series Processes
Lecture 8 - Autocorrelation and the Partial Autocorrelation Functions
Lecture 9 - ACF and PACF for Some Time Series Processes
Lecture 10 - Practical Session in R-2
Lecture 11 - Non-Stationary Time Series
Lecture 12 - Seasonality and its Features
Lecture 13 - Cyclicality and Test for Stationarity
Lecture 14 - Seasonality and SARIMA Model
Lecture 15 - Practical Session in R-3
Lecture 16 - Model Identification
Lecture 17 - Model Estimation
Lecture 18 - Diagnostic Checking - 1
Lecture 19 - Diagnostic Checking - 2
Lecture 20 - Practical Session in R-4
Lecture 21 - Forecasting Basics
Lecture 22 - Measuring Forecast Accuracy
Lecture 23 - Smoothing Techniques (SMA,EMA)
Lecture 24 - Double and Triple Exponential Smoothing
Lecture 25 - Practical Session in R-5
Lecture 26 - Persistent and Long- Memory Processes : Examples and Implications
Lecture 27 - ARFIMA Processes
Lecture 28 - Hurst Exponent - Estimation under ARFIMA
Lecture 29 - Estimation under ARFIMA

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Lecture 30 - Practical Session in R-6
Lecture 31 - Multivariate Time Series Analysis: Examples and Motivation
Lecture 32 - Cross-covariance and Cross-correlation
Lecture 33 - Some Specific Multivariate Time Series Models
Lecture 34 - Further Extensions and Use Cases
Lecture 35 - Practical Session in R-7
Lecture 36 - Cointegration and Further
Lecture 37 - Error Correction Models
Lecture 38 - Tests for Cointegration
Lecture 39 - Testing for Causality
Lecture 40 - Practical Session in R-8
Lecture 41 - Frequency Domain Analysis
Lecture 42 - Spectral Representation of a Series
Lecture 43 - Spectral Density Estimation
Lecture 44 - Numerical Examples and Further
Lecture 45 - Practical Session in R-9
Lecture 46 - Stochastic Volatility Modelling
Lecture 47 - ARCH Models
Lecture 48 - ARCH LM Test and GARCH Models
Lecture 49 - GARCH Model Extensions
Lecture 50 - Practical Session in R-10
Lecture 51 - Nonlinear Time Series Models
Lecture 52 - Regimes and Nonlinear Models
Lecture 53 - Nonlinear Model Extensions
Lecture 54 - Markov Switching Models
Lecture 55 - Practical Session in R-11
Lecture 56 - Machine Learning in Time Series
Lecture 57 - Linear Regression for Time Series and Beyond
Lecture 58 - Other Machine Learning Models for Time Series
Lecture 59 - Neural Networks for Time Series
Lecture 60 - Practical Session in R-12
```

NPTEL Video Course - Computer Science and Engineering - Computational Geometry

Subject Co-ordinator - Prof. Sandeep Sen

Co-ordinating Institute - IIT - Delhi

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction
Lecture 2 - Visibility Problems
Lecture 3 - 2D Maxima
Lecture 4 - Line Sweep Method
Lecture 5 - Segment Intersection Problem
Lecture 6 - Line Sweep
Lecture 7 - Convex Hull
Lecture 8 - Convex Hull Contd
Lecture 9 - Quick Hull
Lecture 10 - More Convex Hull Algorithms
Lecture 11 - Intersection of Half Planes and Duality
Lecture 12 - Intersection of Half Planes and Duality Contd
Lecture 13 - Lower Bounds
Lecture 14 - Planar Point Location
Lecture 15 - Point Location and Triangulation Contd...
Lecture 16 - Triangulation of Arbitrary Polygon
Lecture 17 - Voronoi Diagram
Lecture 18 - Voronoi Diagram Construction
Lecture 19 - Delaunay Triangulation
Lecture 20 - Quick sort and Backward Analysis
Lecture 21 - Generalized RIC
Lecture 22 - RIC Continued
Lecture 23 - Arrangements
Lecture 24 - Zone Theorem and Application
Lecture 25 - Levels
Lecture 26 - Range Searching
Lecture 27 - Orthogonal Range searching
Lecture 28 - Priority Search Trees
Lecture 29 - Non - Orthogonal Range Searching

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Lecture 30 - Half - Plane Range Query
Lecture 31 - Well Separated Partitioning
Lecture 32 - Quadtrees Epsilon -WSPD
Lecture 33 - Construction of Epsilon - WSPD
Lecture 34 - Epsilon - WSPD to Geometric Spanner
Lecture 35 - Epsilon-Nets & VC Dimension
Lecture 36 - Epsilon-Nets & VC Dimension contd
Lecture 37 - Geometric Set Cover
Lecture 38 - Geometric Set Cover (with Bounded VC Dimension)
Lecture 39 - Shape Representation
Lecture 40 - Shape Comparison
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NPTEL Video Course - Computer Science and Engineering - Logic for CS

Subject Co-ordinator - Prof. S. Arun Kumar

Co-ordinating Institute - IIT - Delhi

Sub-Titles - Available / Unavailable │ MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction
Lecture 2 - Propositional Logic Syntax
Lecture 3 - Semantics of Propositional Logic
Lecture 4 - Logical and Algebraic Concepts
Lecture 5 - Identities and Normal forms
Lecture 6 - Tautology Checking
Lecture 7 - Propositional Unsatisfiability
Lecture 8 - Analytic Tableaux
Lecture 9 - Consistency and Completeness
Lecture 10 - The Completeness Theorem
Lecture 11 - Maximally Consistent Sets
Lecture 12 - Formal Theories
Lecture 13 - Proof Theory
Lecture 14 - Derived Rules
Lecture 15 - The Hilbert System
Lecture 16 - The Hilbert System
Lecture 17 - Introduction to Predicate Logic
Lecture 18 - The Semantic of Predicate Logic
Lecture 19 - Subsitutions
Lecture 20 - Models
Lecture 21 - Structures and Substructures
Lecture 22 - First-Order Theories
Lecture 23 - Predicate Logic
Lecture 24 - Existential Quantification
Lecture 25 - Normal Forms
Lecture 26 - Skalemization
Lecture 27 - Substitutions and Instantiations
Lecture 28 - Unification
Lecture 29 - Resolution in FOL

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Lecture 30 - More on Resolution in FOL
Lecture 31 - Resolution
Lecture 32 - Resolution and Tableaux
Lecture 33 - Completeness of Tableaux Method
Lecture 34 - Completeness of the Hilbert System
Lecture 35 - First-Order Theories
Lecture 36 - Towards Logic Programming
Lecture 37 - Verification of Imperative Programs
Lecture 38 - Verification of WHILE Programs
Lecture 39 - References
```

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NPTEL Video Course - Computer Science and Engineering - Computer Architecture (Prof. Anshul Kumar)

Subject Co-ordinator - Prof. Anshul Kumar

Co-ordinating Institute - IIT - Delhi

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to Computer Architecture
Lecture 2 - History of Computers
Lecture 3 - Instruction Set Architecture - I
Lecture 4 - Instruction Set Architecture - II
Lecture 5 - Instruction Set Architecture - III
Lecture 6 - Recursive Programs
Lecture 7 - Architecture Space
Lecture 8 - Architecture Examples
Lecture 9 - Performance
Lecture 10 - Performance
Lecture 11 - Binary Arithmetic, ALU Design
Lecture 12 - ALU Design, Overflow
Lecture 13 - Multiplier Design
Lecture 14 - Divider Design
Lecture 15 - Fast Addition , Multiplication
Lecture 16 - Floating Point Arithmetic
Lecture 17 - Processor Design - Introduction
Lecture 18 - Processor Design
Lecture 19 - Processor Design - Simple Design
Lecture 20 - Processor Design - Multi Cycle Approach
Lecture 21 - Processor Design - Control for Multi Cycle
Lecture 22 - Processor Design - Micro programmed Control
Lecture 23 - Processor Design - Exception Handling
Lecture 24 - Pipelined Processor Design Basic Idea
Lecture 25 - Pipelined Processor Design
Lecture 26 - Pipelined Processor Design
Lecture 27 - Pipelined Processor Design
Lecture 28 - Memory Hierarchy
Lecture 29 - Memory Hierarchy

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Lecture 30 - Memory Hierarchy
Lecture 31 - Memory Hierarchy
Lecture 32 - Memory Hierarchy
Lecture 33 - Input / Output Subsystem
Lecture 34 - Input / Output Subsystem
Lecture 35 - Input / Output Subsystem
Lecture 36 - Input / Output Subsystem
Lecture 37 - Input / Output Subsystem
Lecture 38 - Concluding Remarks
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NPTEL Video Course - Computer Science and Engineering - Data Structures And Algorithms

Subject Co-ordinator - Prof. Naveen Garg

Co-ordinating Institute - IIT - Delhi

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to Data Structures and Algorithms
Lecture 2 - Stacks
Lecture 3 - Queues and Linked Lists
Lecture 4 - Dictionaries
Lecture 5 - Hashing
Lecture 6 - Trees
Lecture 7 - Tree Walks / Traversals
Lecture 8 - Ordered Dictionaries
Lecture 9 - Deletion
Lecture 10 - Quick Sort
Lecture 11 - AVL Trees
Lecture 12 - AVL Trees
Lecture 13 - Trees
Lecture 14 - Red Black Trees
Lecture 15 - Insertion in Red Black Trees
Lecture 16 - Disk Based Data Structures
Lecture 17 - Case Study
Lecture 18 - Tries
Lecture 19 - Data Compression
Lecture 20 - Priority Queues
Lecture 21 - Binary Heaps
Lecture 22 - Why Sorting
Lecture 23 - More Sorting
Lecture 24 - Graphs
Lecture 25 - Data Structures for Graphs
Lecture 26 - Two Applications of Breadth First Search
Lecture 27 - Depth First Search
Lecture 28 - Applications of DFS
Lecture 29 - DFS in Directed Graphs

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Lecture 30 - Applications of DFS in Directed Graphs
Lecture 31 - Minimum Spanning Trees
Lecture 32 - The Union
Lecture 33 - Prims Algorithm for Minimum Spanning Trees
Lecture 34 - Single Source Shortest Paths
Lecture 35 - Correctness of Dijkstras Algorithm
Lecture 36 - Single Source Shortest Paths
```

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NPTEL Video Course - Computer Science and Engineering - Introduction to Computer Graphics

Subject Co-ordinator - Prof. Prem K Kalra

Co-ordinating Institute - IIT - Delhi

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction
Lecture 2 - Raster Graphics
Lecture 3 - Raster Graphics (Continued...)
Lecture 4 - Clipping
Lecture 5 - Polygon Clipping and Polygon Scan Conversion
Lecture 6 - Transformations
Lecture 7 - Transformations (Continued...)
Lecture 8 - 3D Viewing
Lecture 9 - 3D Viewing (Continued...)
Lecture 10 - Curves
Lecture 11 - Assignment - I
Lecture 12 - Curves (Continued...)
Lecture 13 - Curves (Continued...)
Lecture 14 - Curves (Continued...)
Lecture 15 - Curves (Continued...)
Lecture 16 - Surfaces
Lecture 17 - Surfaces (Continued...)
Lecture 18 - Surfaces (Continued...)
Lecture 19 - Surfaces (Continued...)
Lecture 20 - Hierarchical Models
Lecture 21 - Rendering
Lecture 22 - Rendering (Continued...)
Lecture 23 - Rendering (Continued...)
Lecture 24 - Ray Tracing
Lecture 25 - Ray Tracing (Continued...)
Lecture 26 - Ray Tracing (Continued...)
Lecture 27 - Assignment
Lecture 28 - Hidden Surface Elimination
Lecture 29 - Hidden Surface Elimination (Continued...)

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Lecture 30 - Hidden Surface Elimination (Continued...)
Lecture 31 - Fractals
Lecture 32 - Fractals (Continued...)
Lecture 33 - Computer Animation
Lecture 34 - Animation (Continued...)
Lecture 35 - Animation (Continued...)
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NPTEL Video Course - Computer Science and Engineering - Principles of Programming Languages

Subject Co-ordinator - Prof. S. Arun Kumar

Co-ordinating Institute - IIT - Delhi

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction
Lecture 2 - Syntax
Lecture 3 - Grammars
Lecture 4 - Ambiguity
Lecture 5 - PLO
Lecture 6 - Semantics
Lecture 7 - Syntactic Classes
Lecture 8 - Transition Systems
Lecture 9 - PL0
Lecture 10 - Binding
Lecture 11 - Environments
Lecture 12 - Declarations
Lecture 13 - Commands
Lecture 14 - Stores
Lecture 15 - Summary
Lecture 16 - Declarations and Commands
Lecture 17 - Blocks
Lecture 18 - Qualification
Lecture 19 - Pragmatics
Lecture 20 - Data
Lecture 21 - Structured Data
Lecture 22 - Sequences
Lecture 23 - Control
Lecture 24 - Non-Determinacy
Lecture 25 - Programming Languages
Lecture 26 - Programming Languages
Lecture 27 - Programming Languages
Lecture 28 - Data as Functions
Lecture 29 - Data and Fixpoints

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```
Lecture 30 - Normal Forms
Lecture 31 - Programming Languages
Lecture 32 - Monomorphism
Lecture 33 - Polymorphism
Lecture 34 - Type Checking
Lecture 35 - Contexts
Lecture 36 - Abstracts
Lecture 37 - Procedures
Lecture 38 - Meanings
Lecture 39 - Parameters
Lecture 40 - The Future
```

NPTEL Video Course - Computer Science and Engineering - Parallel Computing

Subject Co-ordinator - Dr. Subodh Kumar

Co-ordinating Institute - IIT - Delhi

Sub-Titles - Available / Unavailable │ MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction
Lecture 2 - Parallel Programming Paradigms
Lecture 3 - Parallel Architecture
Lecture 4 - Parallel Architecture (case studies)
Lecture 5 - Open MP
Lecture 6 - Open MP (Continued.)
Lecture 7 - Open MP (Continued..)
Lecture 8 - Open MP & PRAM Model of Computation
Lecture 9 - PRAM
Lecture 10 - Models of Parallel Computation, Complexity
Lecture 11 - Memory Consistency
Lecture 12 - Memory Consistency & Performance Issues
Lecture 13 - Parallel Program Design
Lecture 14 - Shared Memory & Message Passing
Lecture 15 - MPI
Lecture 16 - MPI (Continued.)
Lecture 17 - MPI (Continued..)
Lecture 18 - Algorithmic Techniques
Lecture 19 - Algorithmic Techniques (Continued.)
Lecture 20 - Algorithmic Techniques (Continued..)
Lecture 21 - CUDA
Lecture 22 - CUDA (Continued.)
Lecture 23 - CUDA (Continued..)
Lecture 24 - CUDA (Continued...)
Lecture 25 - CUDA (Continued....)
Lecture 26 - CUDA (Continued.....)
Lecture 27 - CUDA (Continued......)
Lecture 28 - Algorithms, Merging & Sorting
Lecture 29 - Algorithms, Merging & Sorting (Continued.)

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```
Lecture 30 - Algorithms, Merging & Sorting (Continued..)
Lecture 31 - Algorithms, Merging & Sorting (Continued...)
Lecture 32 - Algorithms, Merging & Sorting (Continued....)
Lecture 33 - Lower Bounds Lock Free Synchronization, Load Stealing
Lecture 34 - Lock Free Synchronization, Graph Algorithms
```

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NPTEL Video Course - Computer Science and Engineering - Operating Systems

Subject Co-ordinator - Prof. Sorav Bansal

Co-ordinating Institute - IIT - Delhi

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introductio to UNIX System Calls - Part 1
Lecture 2 - Introductio to UNIX System Calls - Part 2
Lecture 3 - Threads, Address Spaces, Filesystem Devices
Lecture 4 - PC Architecture
Lecture 5 - x86 Instruction Set, GCC Calling Conventions
Lecture 6 - Physical Memory Map, I/O, Segmentation
Lecture 7 - Segmentation, Trap Handling
Lecture 8 - Traps, Trap Handlers
Lecture 9 - Kernel Data Structures, Memory Management
Lecture 10 - Segmentation Review, Introduction to Paging
Lecture 11 - Paging
Lecture 12 - Process Address Spaces Using Paging
Lecture 13 - Translation Lookaside Buffer, Large Pages, Boot Sector
Lecture 14 - Loading the kernel, Initializing the Page table
Lecture 15 - Setting up page tables for user processes
Lecture 16 - Processes in action
Lecture 17 - Process structure, Context Switching
Lecture 18 - Process Kernel stack, Scheduler, Fork,Context-Switch, Process Control Block, Trap Entry and Retu
Lecture 19 - Creating the first process
Lecture 20 - Handling User Pointers, Concurrency
Lecture 21 - Locking
Lecture 22 - Fine-grained Locking and its challenges
Lecture 23 - Locking variations
Lecture 24 - Condition variables
Lecture 25 - Multiple producer, multiple consumer queue; semaphores; monitors
Lecture 26 - Transcations and lock-free primitives read/write locks
Lecture 27 - Synchronization in xv6
Lecture 28 - More synchronization in xv6
Lecture 29 - Demand Paging; Introduction to Page Replacement

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Lecture 30 - Page Replacement, Thrashing
Lecture 31 - Storage Devices, Filesystem Intrerfaces
Lecture 32 - File System Implementation
Lecture 33 - File System Operation
Lecture 34 - Cash Recovery and Logging
Lecture 35 - Logging in Linux ext3 filesystem
Lecture 36 - Protection and Security
Lecture 37 - Scheduling Policies
Lecture 38 - Lock-free multiprocessor coordination, Read-Copy-Update
Lecture 39 - Microkernel, Exokernel, Multikernel
Lecture 40 - Virtualization, Cloud Computing, Technology Trends
```

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NPTEL Video Course - Computer Science and Engineering - NOC:Computer Architecture (2017)

Subject Co-ordinator - Prof. Smruti R.Sarangi

Co-ordinating Institute - IIT - Delhi

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to Computer Architecture
Lecture 2 - The Language of Bits - Part-I
Lecture 3 - The Language of Bits - Part-II
Lecture 4 - The Language of Bits - Part-III
Lecture 5 - Assembly Language - Part-I
Lecture 6 - Assembly Language - Part-II
Lecture 7 - Assembly Language - Part-III
Lecture 8 - ARM Assembly Language - Part-I
Lecture 9 - ARM Assembly Language - Part-II
Lecture 10 - x86 Assembly Language - Part-I
Lecture 11 - x86 Assembly Language - Part-II
Lecture 12 - x86 Assembly Language - Part-III
Lecture 13 - x86 Assembly Language - Part-IV
Lecture 14 - A Primer on Digital Logic - Part-I
Lecture 15 - A Primer on Digital Logic - Part-II
Lecture 16 - A Primer on Digital Logic - Part-III
Lecture 17 - Computer Arithmetic - Part-I
Lecture 18 - Computer Arithmetic - Part-II
Lecture 19 - Computer Arithmetic - Part-III
Lecture 20 - Computer Arithmetic - Part-IV
Lecture 21 - Computer Arithmetic - Part-V
Lecture 22 - Computer Arithmetic - Part-VI
Lecture 23 - Processor Design - Part-I
Lecture 24 - Processor Design - Part-II
Lecture 25 - Processor Design - Part-III
Lecture 26 - Principles of Pipelining - Part-I
Lecture 27 - Principles of Pipelining - Part-II
Lecture 28 - Principles of Pipelining - Part-III
Lecture 29 - Principles of Pipelining - Part-IV

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Lecture 30 - The Memory Systems - Part-I
Lecture 31 - The Memory Systems - Part-II
Lecture 32 - The Memory Systems - Part-III
Lecture 33 - The Memory Systems - Part-IV
```

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NPTEL Video Course - Computer Science and Engineering - NOC:Introduction to Parallel Programming in OpenMP

Subject Co-ordinator - Dr. Yogish Sabharwal

Co-ordinating Institute - IIT - Delhi

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to Parallel Programming
Lecture 2 - Parallel Architectures and Programming Models
Lecture 3 - Pipelining
Lecture 4 - Superpipelining and VLIW
Lecture 5 - Memory Latency
Lecture 6 - Cache and Temporal Locality
Lecture 7 - Cache, Memory bandwidth and Spatial Locality
Lecture 8 - Intuition for Shared and Distributed Memory architectures
Lecture 9 - Shared and Distributed Memory architectures
Lecture 10 - Interconnection networks in Distributed Memory architectures
Lecture 11 - OpenMP: A parallel Hello World Program
Lecture 12 - Program with Single thread
Lecture 13 - Program Memory with Multiple threads and Multi-tasking
Lecture 14 - Context Switching
Lecture 15 - OpenMP: Basic thread functions
Lecture 16 - OpenMP: About OpenMP
Lecture 17 - Shared Memory Consistency Models and the Sequential Consistency Model
Lecture 18 - Race Conditions
Lecture 19 - OpenMP: Scoping variables and some race conditions
Lecture 20 - OpenMP: thread private variables and more constructs
Lecture 21 - Computing sum: first attempt at parallelization
Lecture 22 - Manual distribution of work and critical sections
Lecture 23 - Distributing for loops and reduction
Lecture 24 - Vector-Vector operations (Dot product)
Lecture 25 - Matrix-Vector operations (Matrix-Vector Multiply)
Lecture 26 - Matrix-Matrix operations (Matrix-Matrix Multiply)
Lecture 27 - Introduction to tasks
Lecture 28 - Task queues and task execution
Lecture 29 - Accessing variables in tasks

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Lecture 30 - Completion of tasks and scoping variables in tasks
Lecture 31 - Recursive task spawning and pitfalls
Lecture 32 - Understanding LU Factorization
Lecture 33 - Parallel LU Factorization
Lecture 34 - Locks
Lecture 35 - Advanced Task handling
Lecture 36 - Matrix Multiplication using tasks
Lecture 37 - The OpenMP Shared Memory Consistency Model
Lecture 38 - Applications finite element method
Lecture 39 - Applications deep learning
Lecture 40 - Introduction to MPI and basic calls
Lecture 41 - MPI calls to send and receive data
Lecture 42 - MPI calls for broadcasting data
Lecture 43 - MPI non blocking calls
Lecture 44 - Application distributed histogram updation
Lecture 45 - MPI collectives and MPI broadcast
Lecture 46 - MPI gathering and scattering collectives
Lecture 47 - MPI reduction and alltoall collectives
Lecture 48 - Discussion on MPI collectives design
Lecture 49 - Characteriziation of interconnects
Lecture 50 - Linear arrays 2D mesh and torus
Lecture 51 - d dimensional torus
Lecture 52 - Hypercube
Lecture 53 - Trees and cliques
Lecture 54 - Hockney model
Lecture 55 - Broadcast and Reduce with recursive doubling
Lecture 56 - Scatter and Gather with recursive doubling
Lecture 57 - Reduce scatter and All gather with recursive doubling
Lecture 58 - Discussion of message sizes in analysis
Lecture 59 - Revisiting Reduce scatter on 2D mesh
Lecture 60 - Reduce scatter and Allreduce on the Hypercube
Lecture 61 - Alltoall on the Hypercube
Lecture 62 - Lower bounds
Lecture 63 - Pipeline based algorithm for Allreduce
Lecture 64 - An improved algorithm for Alltoall on the Hypercube using E-cube routing
Lecture 65 - Pipeline based algorithm for Broadcast
Lecture 66 - Introduction to parallel graph algorithms
Lecture 67 - Breadth First Search BFS using matrix algebra
Lecture 68 - BFS Shared memory parallelization using OpenMP
```

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Lecture 69 - Distributed memory settings and data distribution
Lecture 70 - Distributed BFS algorithm
Lecture 71 - Performance considerations
Lecture 72 - Prims Algorithm
Lecture 73 - OpenMP based shared memory parallelization for MST
Lecture 74 - MPI based distributed memory parallelization for MST
Lecture 75 - Sequential Algorithm Adaptation from Prims
Lecture 76 - Parallelization Strategy for Prims algorithm
Lecture 77 - Dry run with the parallel strategy
Lecture 78 - Johnsons algorithm with 1D data distribution
Lecture 79 - Speedup analysis on a grid graph
Lecture 80 - Floyds algorithm for all pair shortest paths
Lecture 81 - Floyds algorithm with 2D data distribution
Lecture 82 - Adaptation to transitive closures
Lecture 83 - Parallelization strategy for connected components
Lecture 84 - Analysis for parallel connected components
```

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NPTEL Video Course - Computer Science and Engineering - NOC:Synthesis of Digital Systems

Subject Co-ordinator - Prof. Preeti Ranjan Panda

Co-ordinating Institute - IIT - Delhi

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Outline - What is Synthesis?
Lecture 2 - Chip Design Flow and Hardware Modelling
Lecture 3 - VHDL
Lecture 4 - VHDL
Lecture 5 - VHDL
Lecture 6 - VHDL
Lecture 7 - Introduction to High-level Synthesis
Lecture 8 - Language front-end Design Representation
Lecture 9 - Compiler Transformation in High Level Synthesis
Lecture 10 - Memory Modelling and Compiler Transformation in High Level Synthesis
Lecture 11 - Compiler Transformations in High Level Synthesis
Lecture 12 - Hardware Transformations and ASAP / ALAP Scheduling
Lecture 13 - Scheduling in High Level Synthesis
Lecture 14 - Force Directed Scheduling and Register Allocation
Lecture 15 - High Level Synthesis and Timing Issues
Lecture 16 - Finite State Machine Synthesis
Lecture 17 - Finite State Machine Synthesis
Lecture 18 - The Retiming Problem
Lecture 19 - Efficient Solution to Retiming and Introduction to Logic Synthesis
Lecture 20 - Binary Decision Diagrams
Lecture 21 - Introduction to Logic Synthesis
Lecture 22 - Two-level Logic Optimisation
Lecture 23 - Multi-Level Logic Optimisation
Lecture 24 - Multi-level Logic Synthesis
Lecture 25 - Introduction to Timing Analysis
Lecture 26 - Timing Analysis and Critical Paths

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NPTEL Video Course - Computer Science and Engineering - NOC:An Introduction to Artificial Intelligence

Subject Co-ordinator - Prof. Mausam

Co-ordinating Institute - IIT - Delhi

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction
Lecture 2 - Introduction
Lecture 3 - Introduction
Lecture 4 - Introduction
Lecture 5 - Introduction
Lecture 6 - Introduction
Lecture 7 - Introduction
Lecture 8 - Introduction
Lecture 9 - Introduction
Lecture 10 - Uniform Search
Lecture 11 - Uniformed Search
Lecture 12 - Uniformed Search
Lecture 13 - Uniformed Search
Lecture 14 - Uniformed Search
Lecture 15 - Informed Search
Lecture 16 - Informed Search
Lecture 17 - Informed Search
Lecture 18 - Informed Search Proof of optimality of A* - Part 4
Lecture 19 - Informed Search
Lecture 20 - Informed Search
Lecture 21 - Informed Search
Lecture 22 - Local Search
Lecture 23 - Local Search
Lecture 24 - Local Search
Lecture 25 - Local Search
Lecture 26 - Local Search
Lecture 27 - Local Search
Lecture 28 - Local Search
Lecture 29 - Adversarial Search

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Lecture 30 - Adversarial Search
Lecture 31 - Adversarial Search
Lecture 32 - Adversarial Search
Lecture 33 - Adversarial Search
Lecture 34 - Adversarial Search
Lecture 35 - Adversarial Search
Lecture 36 - Constraint Satisfaction Problems
Lecture 37 - Constraint Satisfaction Problems
Lecture 38 - Constraint Satisfaction Problems
Lecture 39 - Constraint Satisfaction Problems
Lecture 40 - Constraint Satisfaction Problems
Lecture 41 - Constraint Satisfaction Problems
Lecture 42 - Logic in AI
Lecture 43 - Logic in AI
Lecture 44 - Logic in AI
Lecture 45 - Logic in AI
Lecture 46 - Logic in AI
Lecture 47 - Logic in AI
Lecture 48 - Logic in AI
Lecture 49 - Logic in AI
Lecture 50 - Uncertainty in AI
Lecture 51 - Uncertainty in AI
Lecture 52 - Uncertainty in AI
Lecture 53 - Bayesian Networks
Lecture 54 - Bayesian Networks
Lecture 55 - Bayesian Networks
Lecture 56 - Bayesian Networks
Lecture 57 - Bayesian Networks
Lecture 58 - Bayesian Networks
Lecture 59 - Bayesian Networks
Lecture 60 - Bayesian Networks
Lecture 61 - Bayesian Networks
Lecture 62 - Bayesian Networks
Lecture 63 - Bayesian Networks
Lecture 64 - Bayesian Networks
Lecture 65 - Introduction, Part 10
Lecture 66 - Decision Theory
Lecture 67 - Decision Theory
Lecture 68 - Probabilistic Uncertainty and Value of perfect information
```

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Lecture 69 - Expected Utility vs Expected Value
Lecture 70 - Markov Decision Processes
Lecture 71 - Markov Decision Processes
Lecture 72 - Markov Decision Processes
Lecture 73 - Markov Decision Processes
Lecture 74 - Markov Decision Processes
Lecture 75 - Markov Decision Processes
Lecture 76 - Reinforcement Learning
Lecture 77 - Reinforcement Learning
Lecture 78 - Reinforcement Learning
Lecture 79 - Reinforcement Learning
Lecture 80 - Reinforcement Learning
Lecture 81 - Reinforcement Learning
Lecture 82 - Reinforcement Learning
Lecture 83 - Reinforcement Learning
Lecture 84 - Deep Learning
Lecture 85 - Deep Learning
Lecture 86 - Deep Learning
Lecture 87 - Deep Learning
Lecture 88 - Deep Learning
Lecture 89 - Deep Learning
Lecture 90 - Deep Learning
Lecture 91 - Deep Learning
Lecture 92 - Ethics of AI
Lecture 93 - Ethics of AI
Lecture 94 - Ethics of AI
Lecture 95 - Ethics of AI
Lecture 96 - Wrapup
```

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NPTEL Video Course - Computer Science and Engineering - NOC:Advanced Computer Architecture (2021)

Subject Co-ordinator - Prof. Smruti R. Sarangi

Co-ordinating Institute - IIT - Delhi

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction
Lecture 2 - Out-of-Order Pipelines - Part I
Lecture 3 - Out-of-Order Pipelines - Part II
Lecture 4 - Out-of-Order Pipelines - Part III
Lecture 5 - The Fetch and Decode Stages - Part I
Lecture 6 - The Fetch and Decode Stages - Part II
Lecture 7 - The Fetch and Decode Stages - Part III
Lecture 8 - The Issue, Execute, and Commit Stages - Part I
Lecture 9 - The Issue, Execute, and Commit Stages - Part II
Lecture 10 - The Issue, Execute, and Commit Stages - Part III
Lecture 11 - The Issue, Execute, and Commit Stages - Part IV
Lecture 12 - Alternative Approaches to Issue and Commit - Part I
Lecture 13 - Alternative Approaches to Issue and Commit - Part II
Lecture 14 - Alternative Approaches to Issue and Commit - Part III
Lecture 15 - Alternative Approaches to Issue and Commit - Part IV
Lecture 16 - Graphics Processors - Part I
Lecture 17 - Graphics Processors - Part II
Lecture 18 - Graphics Processors - Part III
Lecture 19 - Caches - Part I
Lecture 20 - Caches - Part II
Lecture 21 - Caches - Part III
Lecture 22 - Caches - Part IV
Lecture 23 - Caches - Part V
Lecture 24 - Caches - Part VI
Lecture 25 - Multicore Systems - Part I
Lecture 26 - Multicore Systems - Part II
Lecture 27 - Multicore Systems - Part III
Lecture 28 - Multicore Systems - Part IV
Lecture 29 - Multicore Systems - Part V

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Lecture 30 - Multicore Systems - Part VI
Lecture 31 - Multicore Systems - Part VII
Lecture 32 - Multicore Systems - Part VIII
Lecture 33 - Multicore Systems - Part IX
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NPTEL Video Course - Computer Science and Engineering - NOC:Advanced Distributed systems

Subject Co-ordinator - Prof. Smruti R. Sarangi

Co-ordinating Institute - IIT - Delhi

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1
Lecture 2
Lecture 3
Lecture 4
Lecture 5
Lecture 6
Lecture 7
Lecture 8
Lecture 9
Lecture 10
Lecture 11
Lecture 12
Lecture 13
Lecture 14
Lecture 15
Lecture 16
Lecture 17
Lecture 18
Lecture 19
Lecture 20
Lecture 21
Lecture 22
Lecture 23
Lecture 24
Lecture 25
Lecture 26
Lecture 27
Lecture 28

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NPTEL Video Course - Computer Science and Engineering - NOC:Introduction to Large Language Models (LLMs)

Subject Co-ordinator - Prof. Tanmoy Chakraborty, Prof. Soumen Chakraborti

Co-ordinating Institute - IIT - Delhi

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction and Recent Advances
Lecture 2 - Introduction to Natural Language Processing
Lecture 3 - Introduction to Statistical Language Models
Lecture 4 - Statistical LM: Advanced Smoothing and Evaluation
Lecture 5 - Introduction to Deep Learning
Lecture 6 - Introduction to PyTorch
Lecture 7 - Word Representation: Word2Vec and fastText
Lecture 8 - Word Representation: GloVe
Lecture 9 - Tokenization Strategies
Lecture 10 - Neural Language Models: CNN and RNN
Lecture 11 - Neural Language Models: LSTM and GRU
Lecture 12 - Sequence-to-Sequence Models
Lecture 13 - Decoding Strategies
Lecture 14 - Attention in Sequence-to-Sequence Models
Lecture 15 - Introduction to Transformer: Self and Multi-Head Attention
Lecture 16 - Introduction to Transformer: Positional Encoding and Layer Normalization
Lecture 17 - Implementation of Transformer using PyTorch
Lecture 18 - Pre-Training Strategies: ELMo, BERT
Lecture 19 - Pre-Training Strategies: Encoder-decoder and Decoder-only Models
Lecture 20 - Introduction to Hugging Face
Lecture 21 - Instruction Tuning
Lecture 22 - Prompt-based Learning
Lecture 23 - Advanced Prompting and Prompt Sensitivity
Lecture 24 - Alignment of Language Models - I
Lecture 25 - Alignment of Language Models - II
Lecture 26 - Knowledge and Retrieval: Knowledge Graph
Lecture 27 - Knowledge and Retrieval: Knowledge Graph Completion and Evaluation
Lecture 28 - Knowledge and Retrieval: Translation and Rotation Models
Lecture 29 - Parameter Efficient Fine-Tuning (PEFT)

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Lecture 30 - Quantization, Pruning and Distillation
Lecture 31 - An Alternate Formulation of Transformers: Residual Stream Perspective
Lecture 32 - Interpretability Techniques
Lecture 33 - Knowledge and Retrieval: Multiplicative models
Lecture 34 - Knowledge and Retrieval: Modeling Hierarchies
Lecture 35 - Knowledge and Retrieval: Temporal Knowledge Graphs
Lecture 36 - Responsible LLMs
Lecture 37 - Conclusion: Expert Panel Discussion

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NPTEL Video Course - Computer Science and Engineering - Design Verification and Test of Digital VLSI Circuits

Subject Co-ordinator - Dr. Santosh Biswas, Prof. Jatindra Kumar Deka

Co-ordinating Institute - IIT - Guwahati

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to Digital VLSI Design Flow
Lecture 2 - High Level Design Representation
Lecture 3 - Transformations for High Level Synthesis
Lecture 4 - Introduction to HLS
Lecture 5 - Scheduling Algorithms - 1
Lecture 6 - Scheduling Algorithms - 2
Lecture 7 - Binding and Allocation Algorithms
Lecture 8 - Two level Boolean Logic Synthesis - 1
Lecture 9 - Two level Boolean Logic Synthesis - 2
Lecture 10 - Two level Boolean Logic Synthesis - 3
Lecture 11 - Heuristic Minimization of Two-Level Circuits
Lecture 12 - Finite State Machine Synthesis
Lecture 13 - Multilevel Implementation
Lecture 14 - Introduction to formal methods for design verification
Lecture 15 - Temporal Logic
Lecture 16 - Syntax and Semantics of CTL
Lecture 17 - Syntax and Semantics of CTL â   Continued
Lecture 18 - Equivalence between CTL Formulas
Lecture 19 - Introduction to Model Checking
Lecture 20 - Model Checking Algorithms - I
Lecture 21 - Model Checking Algorithms - II
Lecture 22 - Model Checking with Fairness
Lecture 23 - Binary Decision Diagram
Lecture 24 - Ordered Binary Decision Diagram
Lecture 25 - Operation on Ordered Binary Decision Diagram
Lecture 26 - Ordered Binary Decision Diagram for State Transition Systems
Lecture 27 - Symbolic Model Checking
Lecture 28 - Introduction to Digital VLSI Testing
Lecture 29 - Functional and Structural Testing

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Lecture 30 - Fault Equivalence
Lecture 31 - Fault Simulation - 1
Lecture 32 - Fault Simulation - 2
Lecture 33 - Fault Simulation - 3
Lecture 34 - Testability Measures (SCOAP)
Lecture 35 - Introduction to Automatic Test Pattern Generation (ATPG) and ATPG Algebras
Lecture 36 - D-Algorithm - 1
Lecture 37 - D-Algorithm - 2
Lecture 38 - ATPG for Synchronous Sequential Circuits
Lecture 39 - Scan Chain based Sequential Circuit Testing - 1
Lecture 40 - Scan Chain based Sequential Circuit Testing - 2
Lecture 41 - Built in Self Test - 1
Lecture 42 - Built in Self Test - 2
Lecture 43 - Memory Testing - 1
Lecture 44 - Memory Testing - 2
```

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NPTEL Video Course - Computer Science and Engineering - NOC:Computer Organization and Architecture - A Pedago

Subject Co-ordinator - Prof.Arnab sarkar, Prof.Jatindra Kumar Deka, Dr. Santosh Biswas

Co-ordinating Institute - IIT - Guwahati

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Model of Computer and Working Principle
Lecture 2 - Digital Logic Building Blocks
Lecture 3 - Information Representation and Number Systems
Lecture 4 - Basic Elements of a Processor
Lecture 5 - Storage and I/O Interface
Lecture 6 - Execution of Program and Programming Languages
Lecture 7 - Components of Central Processing Unit (CPU) and External Interface
Lecture 8 - Main Memory
Lecture 9 - Instruction Execution
Lecture 10 - Instruction Format
Lecture 11 - Instruction Set
Lecture 12 - Addressing Modes
Lecture 13 - Flags and Conditional Instructions
Lecture 14 - Instruction
Lecture 15 - Instruction Cycle and Micro-operations
Lecture 16 - Control Signals and Timing Sequence
Lecture 17 - Control Signals for Complete Instruction Execution
Lecture 18 - Handling Different Addressing Modes
Lecture 19 - Handling Control Transfer Instructions
Lecture 20 - Design of Hardwired controlled Control Unit
Lecture 21 - Microinstructions and Microprograms
Lecture 22 - Organization and Optimization of Microprogrammed controlled Control Unit
Lecture 23 - Different Internal CPU Bus Organization
Lecture 24 - Basics of Memory and Cache - Part 1
Lecture 25 - Basics of Memory and Cache - Part 2
Lecture 26 - Direct-mapped Caches
Lecture 27 - Associative and Multi-level Caches
Lecture 28 - Summary - Caches
Lecture 29 - Basics of Virtual Memory and Address Translation

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Lecture 30 - Paging and Segmentation
Lecture 31 - TLBs and Page Fault Handling
Lecture 32 - Cache Indexing and Tagging Variations, Demand Paging
Lecture 33 - Page Replacement Algorithms
Lecture 34 - Page Frame Allocation and Thrashing
Lecture 35 - Summary - Virtual Memory
Lecture 36 - Input-Output Primitives
Lecture 37 - Interrupt Driven I/O
Lecture 38 - DMA Transfer
Lecture 39 - Storage Devices
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NPTEL Video Course - Computer Science and Engineering - NOC:Embedded Systems-Design Verification and Test

Subject Co-ordinator - Prof.Jatindra Kumar Deka, Dr. Santosh Biswas, Prof.Arnab Sarkar

Co-ordinating Institute - IIT - Guwahati

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction
Lecture 2 - Modeling Techniques - 1
Lecture 3 - Modeling Techniques - 2
Lecture 4 - Hardware/Software Partitioning - 1
Lecture 5 - Hardware/Software Partitioning - 2
Lecture 6 - Introduction to Hardware Design
Lecture 7 - Hardware Architectural Synthesis - 1
Lecture 8 - Hardware Architectural Synthesis - 2
Lecture 9 - Hardware Architectural Synthesis - 3
Lecture 10 - Hardware Architectural Synthesis - 4
Lecture 11 - Hardware Architectural Synthesis - 5
Lecture 12 - Hardware Architectural Synthesis - 6
Lecture 13 - Hardware Architectural Synthesis - 7
Lecture 14 - System Level Analysis
Lecture 15 - Uniprocessor Scheduling - 1
Lecture 16 - Uniprocessor Scheduling - 2
Lecture 17 - Multiprocessor Scheduling - 1
Lecture 18 - Multiprocessor Scheduling - 2
Lecture 19 - Introduction and Basic Operators of Temporal Logic
Lecture 20 - Syntax and Semantics of CTL
Lecture 21 - Equivalence between CTL formulas
Lecture 22 - Model Checking Algorithm
Lecture 23 - Binary Decision Diagram
Lecture 24 - Use of OBDDs for State Transition System
Lecture 25 - Symbolic Model Checking
Lecture 26 - Introduction to Digital VLSI Testing
Lecture 27 - Automatic Test Pattern Generation (ATPG)
Lecture 28 - Scan Chain based Sequential Circuit Testing
Lecture 29 - Software-Hardware Co-validation Fault Models and High Level Testing for Complex Embedded Systems

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Lecture 30 - Testing for embedded cores
Lecture 31 - Bus and Memory Testing
Lecture 32 - Testing for advanced faults in Real time Embedded Systems
Lecture 33 - BIST for Embedded Systems
Lecture 34 - Concurrent Testing for Fault tolerant Embedded Systems - 1
Lecture 35 - Concurrent Testing for Fault tolerant Embedded Systems - 2
Lecture 36 - Testing for Re-programmable hardware
Lecture 37 - Interaction Testing between Hardware and Software
```

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NPTEL Video Course - Computer Science and Engineering - NOC:Multi-Core Computer Architecture-Storage and Inte

Subject Co-ordinator - Prof. John Jose

Co-ordinating Institute - IIT - Guwahati

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction and Overview of the Course
Lecture 2 - Instruction Execution Principles
Lecture 3 - Introduction to Instruction Pipeline
Lecture 4 - Introduction to Superscalar Pipelines
Lecture 5 - Instruction Pipeline and Performance - I
Lecture 6 - Instruction Pipeline and Performance - II
Lecture 7 - Introduction to Cache Memory
Lecture 8 - Block Replacement Techniques and Write Strategy
Lecture 9 - gem5 Simulator - An Overview
Lecture 10 - Cache Memory
Lecture 11 - Basic Cache Optimization Techniques
Lecture 12 - gem5 Simulator - Cache Optimisation
Lecture 13 - Advanced Cache Optimization Techniques - I
Lecture 14 - Advanced Cache Optimization Techniques - II
Lecture 15 - Cache Memory Optimizations
Lecture 16 - Introduction to DRAM System
Lecture 17 - DRAM Controllers and Address Mapping
Lecture 18 - Address Translation Mechanisms
Lecture 19 - Main Memory Concepts
Lecture 20 - Introduction to Tiled Chip Multicore Processors
Lecture 21 - Routing Techniques in Network On Chip
Lecture 22 - Network On Chip Router Micro-Architecture
Lecture 23 - gem5 Simulator - NoC Optimisation
Lecture 24 - Energy Efficient Bufferless NoC Routers
Lecture 25 - Sidebuffered Deflection Routers
Lecture 26 - Concepts in Network on Chip
Lecture 27 - QoS of NoC and Caches in TCMP Systems
Lecture 28 - Emerging Trends in Network On Chips
Lecture 29 - Concepts in TCMP Systems

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NPTEL Video Course - Computer Science and Engineering - NOC:Multi-Core Computer Architecture

Subject Co-ordinator - Prof. John Jose

Co-ordinating Institute - IIT - Guwahati

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Review of Basic Computer Organization
Lecture 2 - Instruction Set and Addressing Modes
Lecture 3 - Instruction Encoding
Lecture 4 - Performance Evaluation Methods
Lecture 5 - Tutorial on Performance Evaluvation
Lecture 6 - Introduction to RISC Instruction Pipeline
Lecture 7 - Instruction Pipeline Hazards
Lecture 8 - Tutorial on Instruction Pipeline and Hazards
Lecture 9 - Control Hazards and Branch Prediction
Lecture 10 - MIPS Pipeline for Multi-Cycle Operations
Lecture 11 - Tutorial on Longer Pipeline and Branch Prediction
Lecture 12 - Compiler Techniques to Explore ILP
Lecture 13 - Dynamic Scheduling to Explore ILP
Lecture 14 - Dynamic Scheduling with Tomasulo's Algorithm
Lecture 15 - Dynamic Scheduling with Speculative Execution
Lecture 16 - Tutorial on Static and Dynamic Scheduling
Lecture 17 - Advanced Pipelining and Superscalar Processors
Lecture 18 - Introduction to GPU architectures
Lecture 19 - Case study on GPU architectures
Lecture 20 - Tutorial on Superscalar processors and GPU
Lecture 21 - Introduction to Cache Memory
Lecture 22 - Block Replacement Techniques and Write Strategy
Lecture 23 - Design Concepts in Cache Memory
Lecture 24 - Optimization Techniques in Cache Memory
Lecture 25 - Advanced Cache Optimization Techniques
Lecture 26 - Tutorial on Advanced Concepts in Cache Memory - 1
Lecture 27 - Tutorial on Advanced Concepts in Cache Memory - 2
Lecture 28 - Cache coherence and memory consistency
Lecture 29 - Design Space for snooping protocols

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Lecture 30 - Directory Based Cache coherehce
Lecture 31 - Cache coherence in multiprocessor design [T]
Lecture 32 - Introduction to DRAM System
Lecture 33 - DRAM Controllers and Address Mapping
Lecture 34 - Secondary Storage Systems
Lecture 35 - Design Concepts in Storage Systems
Lecture 36 - Introduction to Tiled Chip Multicore Processors
Lecture 37 - Routing Techniques in Network On Chip
Lecture 38 - Network On Chip Router Micro-Architecture
Lecture 39 - Concepts in Network on Chip
Lecture 40 - Energy Efficient Bufferless NoC Routers
Lecture 41 - Sidebuffered Deflection Routers
Lecture 42 - Concepts in Deflection Routers [T]
Lecture 43 - QoS of NoC and Caches in TCMP Systems
Lecture 44 - Emerging Trends in Network On Chips
Lecture 45 - Domain Specific Accelarators
Lecture 46 - Introduction to VEGA Microprocessors (Case Study)
Lecture 47 - Concepts in TCMP Systems
Lecture 48 - How to Explore Computer Architecture?

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NPTEL Video Course - Computer Science and Engineering - NOC:Randomized Algorithms

Subject Co-ordinator - Prof. Benny George K

Co-ordinating Institute - IIT - Guwahati

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to Randomized Algorithms
Lecture 2 - Randomized Mincut Algorithm
Lecture 3 - Randomized Find
Lecture 4 - Probability Review
Lecture 5 - Expectation of Random Variables
Lecture 6 - Conditional Probability and Conditional Expectation2
Lecture 7 - Birthday Paradox
Lecture 8 - Markov and Chebychev's Inequalities
Lecture 9 - Median Algorithm
Lecture 10 - Chernoff Bound
Lecture 11 - Permutation Routing on a Hypercube
Lecture 12 - Permutation Routing on a Hypercube (Analysis)
Lecture 13 - Introduction to Probabilistic Method
Lecture 14 - More Examples on Probabilistic Method
Lecture 15 - Lovasz Local Lemma
Lecture 16 - Introduction to Markov Chains
Lecture 17 - 2-SAT and Markov Chains
Lecture 18 - 3-SAT and Markov Chains
Lecture 19 - Electrical Networks
Lecture 20 - Cover Time
Lecture 21 - Rapid Mixing
Lecture 22 - Introduction to Computational Complexity
Lecture 23 - Pratt's Certificate
Lecture 24 - Primality Testing
Lecture 25 - Miller Rabin Algorithm
Lecture 26 - All pair shortest path - I
Lecture 27 - All pair shortest path - II
Lecture 28 - Randomized MST
Lecture 29 - Introduction to approximate counting

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Lecture 30 - DNF counting
Lecture 31 - Perfect Matching - I
Lecture 32 - Perfect Matching - II
Lecture 33 - Perfect Matching - III
Lecture 34 - Treaps
Lecture 35 - Hashing
Lecture 36 - Probabilistically checkable proofs - I
Lecture 37 - Probabilistically checkable proofs - II
Lecture 38 - Probabilistically checkable proofs - III
Lecture 39 - LFKN Protocol
Lecture 40 - summary
```

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NPTEL Video Course - Computer Science and Engineering - NOC:Parallel Algorithms

Subject Co-ordinator - Prof. Sajith Gopalan

Co-ordinating Institute - IIT - Guwahati

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Shared Memory Models - 1
Lecture 2 - Shared Memory Models - 2
Lecture 3 - Interconnection Networks
Lecture 4 - Cost and Optimality
Lecture 5 - Basic Techniques - 1
Lecture 6 - Basic Techniques - 2
Lecture 7 - Basic Techniques - 3
Lecture 8 - Basic Techniques - 4
Lecture 9 - Basic Techniques - 5
Lecture 10 - Odd Even Merge Sort (OEMS)
Lecture 11 - OEMS, Bitonic-Sort-Merge Sort (BSMS)
Lecture 12 - BSMS, Optimal List Colouring
Lecture 13 - Description
Lecture 14 - Analysis
Lecture 15 - Applications
Lecture 16 - Applications
Lecture 17 - Fast optimal merge algorithm
Lecture 18 - High level Description
Lecture 19 - Cole's Merge Sort
Lecture 20 - Analysis of Cole's Merge Sort; Lower bound for sorting
Lecture 21 - Sorting Lower bound; Connected Components
Lecture 22 - Connected Components (CREW)
Lecture 23 - Connected Components, Vertex Colouring
Lecture 24 - Sorting on a 2D mesh
Lecture 25 - Sorting on a 2D mesh
Lecture 26 - Sorting, Offline routing on a 2D mesh
Lecture 27 - Sorting on a 3D mesh
Lecture 28 - Mesh of Trees, Hypercube
Lecture 29 - Hypercube (Continued...)

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Lecture 30 - Hypercube (Continued...), butterfly network
Lecture 31 - Butterfly, CCC and Benes Networks
Lecture 32 - Butterfly, CCC and Benes Networks
Lecture 33 - Shuffle Exchange Graphs, de Bruijn Graphs
Lecture 34 - Interconnection Networks Algorithms
Lecture 35 - Circuit Value Problem is P-complete for NC-reductions
Lecture 36 - Ordered DFS is P-complete for NC-reductions
Lecture 37 - Max Flow is P-complete for NC-reductions
```

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NPTEL Video Course - Computer Science and Engineering - NOC:Discrete Mathematics (Prof. Sajith Gopalan)

Subject Co-ordinator - Prof. Benny George K

Co-ordinating Institute - IIT - Guwahati

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Boolean Functions
Lecture 2 - Propositional Calculus
Lecture 3 - First Order Logic
Lecture 4 - First Order Logic
Lecture 5 - Proof System for Propcal
Lecture 6 - First Order Logic
Lecture 7 - Soundness and Completeness of the First Order Proof System
Lecture 8 - Sets, Relations, Functions
Lecture 9 - Functions, Embedding of the theories of naturals numbers and integers in Set Theory
Lecture 10 - Embedding of the theories of integers and rational numbers in Set Theory; Countable Sets
Lecture 11 - Introduction to graph theory
Lecture 12 - Trees, Cycles, Graph coloring
Lecture 13 - Bipartitie Graphs
Lecture 14 - Bipartitie Graphs; Edge Coloring and Matching
Lecture 15 - Planar Graphs
Lecture 16 - Graph Searching; BFS and DFS
Lecture 17 - Network Flows
Lecture 18 - Counting Spanning Trees in Complete Graphs
Lecture 19 - Embedding of the theory of ral numbers in Set Theory; Paradoxes
Lecture 20 - ZF Axiomatization of Set Theory
Lecture 21 - Partially ordering relations
Lecture 22 - Natural numbers, divisors
Lecture 23 - Lattices
Lecture 24 - GCD, Euclid's Algorithm
Lecture 25 - Prime Numbers
Lecture 26 - Congruences
Lecture 27 - Pigeon Hole Principle
Lecture 28 - Stirling Numbers, Bell Numbers
Lecture 29 - Generating Functions

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Lecture 30 - Product of Generating Functions
Lecture 31 - Composition of Generating Function
Lecture 32 - Principle of Inclusion Exclusion
Lecture 33 - Rook placement problem
Lecture 34 - Solution of Congruences
Lecture 35 - Chinese Remainder Theorem
Lecture 36 - Totient; Congruences; Floor and Ceiling Functions
Lecture 37 - Introduction to Groups
Lecture 38 - Modular Arithmetic and Groups
Lecture 39 - Dihedral Groups, Isomorhphisms
Lecture 40 - Cyclic groups, Direct Products, Subgroups
Lecture 41 - Cosets, Lagrange's theorem
Lecture 42 - Rings and Fields
Lecture 43 - Construction of Finite Fields
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NPTEL Video Course - Computer Science and Engineering - NOC:Advanced Computer Architecture

Subject Co-ordinator - Prof. John Jose

Co-ordinating Institute - IIT - Guwahati

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Review of Basic Computer Organization
Lecture 2 - Perfomance Evaluation Methods
Lecture 3 - Introduction to RISC Instruction Pipeline
Lecture 4 - Instruction Pipeline and Performance
Lecture 5 - Pipeline Hazards
Lecture 6 - Control Hazards and Branch Prediction
Lecture 7 - MIPS Pipeline for Multi-Cycle Operations
Lecture 8 - Tutorial 2
Lecture 9 - Compiler Techniques to Explore ILP
Lecture 10 - Dynamic Scheduling to Explore ILP
Lecture 11 - Dynamic Scheduling with Tomasuloâ s Algorithm
Lecture 12 - Dynamic Scheduling with Speculative Execution
Lecture 13 - Tutorial 3
Lecture 14 - Advanced Pipelining and Superscalar Processors
Lecture 15 - Exploiting DLP
Lecture 16 - Tutorial 4
Lecture 17 - Tutorial 5
Lecture 18 - Introduction to Cache Memory
Lecture 19 - Block Replacement Techniques and Write Strategy
Lecture 20 - Tutorial 6
Lecture 21 - Optimization Techniques in Cache Memory
Lecture 22 - Advanced Cache Optimization Techniques
Lecture 23 - Tutorial 7
Lecture 24 - Tutorial 8
Lecture 25 - Introduction to DRAM System
Lecture 26 - DRAM Controllers and Address Mapping
Lecture 27 - Secondary Storage Systems
Lecture 28 - Tutorial 9
Lecture 29 - Tiled Chip Multicore Processors

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Lecture 30 - Routing Techniques in Network on Chip
Lecture 31 - NoC Router Microarchitecture
Lecture 32 - How to Explore Computer Architecture?
Lecture 33 - Tutorial 10

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NPTEL Video Course - Computer Science and Engineering - NOC:User-centric Computing for Human-Computer Interac

Subject Co-ordinator - Prof. Samit Bhattacharya

Co-ordinating Institute - IIT - Guwahati

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to UCC and history
Lecture 2 - Issues and challenges
Lecture 3 - Latest research trends
Lecture 4 - User-Centric Design and Software Engineering
Lecture 5 - Components of SDLC - Contextual Inquiry
Lecture 6 - Components of SDLC - Design Guidelines
Lecture 7 - Components of SDLC - Prototyping
Lecture 8 - Case study (web site design)
Lecture 9 - Introduction to User-Centric Computing
Lecture 10 - The UCC framework with illustrative case study
Lecture 11 - User-centric models - introduction and descriptive models
Lecture 12 - User-centric models - predictive models and taxonomy
Lecture 13 - Introduction to GOMS family of models
Lecture 14 - Keystroke-Level Model (KLM)
Lecture 15 - (CMN)GOMS Model
Lecture 16 - The Fitts' Law
Lecture 17 - The Hick-Hyman Law
Lecture 18 - 2D and 3D pointing models
Lecture 19 - The Steering Law for constrained navigation
Lecture 20 - Model for hierarchical menu selection
Lecture 21 - Mobile typing models (single finger and two thumb typing)
Lecture 22 - Model for touch performance (FFitts' law)
Lecture 23 - Introduction to formal models in UCD
Lecture 24 - Formal modeling of user-computer dialogue
Lecture 25 - Case studies on the use of models
Lecture 26 - Introduction and research question formulation
Lecture 27 - Variables determination and experiment design
Lecture 28 - Data analysis including model building
Lecture 29 - Introduction to user-centric design evaluation and expert evaluation technique

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Lecture 30 - User evaluation, empirical and model-based evaluation
Lecture 31 - Concluding remarks

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NPTEL Video Course - Computer Science and Engineering - NOC:Computer Graphics

Subject Co-ordinator - Prof. Samit Bhattacharya

Co-ordinating Institute - IIT - Guwahati

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to graphics
Lecture 2 - Historical evolution, issues and challenges
Lecture 3 - Basics of a graphics system
Lecture 4 - Introduction to 3D graphics pipeline
Lecture 5 - Introduction and overview on object representation techniques
Lecture 6 - Various Boundary Representation Techniques
Lecture 7 - Spline representation - I
Lecture 8 - Spline representation - II
Lecture 9 - Space representation methods
Lecture 10 - Introduction to modeling transformations
Lecture 11 - Matrix representation and composition of transformations
Lecture 12 - Transformations in 3D
Lecture 13 - Color computation - basic idea
Lecture 14 - Simple lighting model
Lecture 15 - Shading models
Lecture 16 - Intensity mapping
Lecture 17 - Color models and texture synthesis
Lecture 18 - View transformation
Lecture 19 - Projection transformation
Lecture 20 - Windows-to-viewport transformation
Lecture 21 - Clipping introduction and 2D point and line clipping
Lecture 22 - 2D fill-area clipping and 3D clipping
Lecture 23 - Hidden surface removal - I
Lecture 24 - Hidden surface removal - II
Lecture 25 - Scan conversion of basic shapes - I
Lecture 26 - Scan conversion of basic shapes - II
Lecture 27 - Fill area and character scan conversion
Lecture 28 - Anti-aliasing techniques
Lecture 29 - Graphics I/O Devices

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Lecture 30 - Introduction to GPU and Shaders
Lecture 31 - Programming with OpenGL
Lecture 32 - Concluding remarks

NPTEL Video Course - Computer Science and Engineering - NOC:C-Based VLSI Design

Subject Co-ordinator - Prof. Chandan Karfa

Co-ordinating Institute - IIT - Guwahati

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to C-Based VLSI Design
Lecture 2 - C-based VLSI Design: An Overview
Lecture 3 - C-based VLSI Design: Problem Formulation
Lecture 4 - C-based VLSI Design: Course Plan
Lecture 5 - Introduction to Scheduling
Lecture 6 - ILP formulation of Scheduling
Lecture 7 - ILP formulation of MRLC and MLRC Scheduling
Lecture 8 - Multiprocessor Scheduling
Lecture 9 - Huâ s algorithm for Multiprocessor Scheduling
Lecture 10 - List based Scheduling of MLRC
Lecture 11 - List based Scheduling of MRLC
Lecture 12 - Forced Directed Scheduling
Lecture 13 - Forced Directed MLRC and MRLC Scheduling Algorithm
Lecture 14 - Path Based Scheduling
Lecture 15 - Path Based Scheduling
Lecture 16 - Allocation and Binding Problem Formulation
Lecture 17 - Left Edge Algorithm
Lecture 18 - ILP Formulation of Allocation and Binding
Lecture 19 - Allocation and Binding for Hierarchical Graph
Lecture 20 - Register Allocation and Binding
Lecture 21 - Multi-port Binding Problem
Lecture 22 - Datapath and Controller Synthesis
Lecture 23 - HLS for Arrays
Lecture 24 - HLS for Loops
Lecture 25 - HLS for Loop - pipeline
Lecture 26 - Hardware Efficient C Coding - Part I
Lecture 27 - Hardware Efficient C Coding - Part II
Lecture 28 - Dataflow Optimization in HLS
Lecture 29 - Frontend Optimizations in C

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Lecture 30 - HLS Optimizations: Case Study 1
Lecture 31 - HLS Optimizations: Case Study 1
Lecture 32 - Simulation based Verification
Lecture 33 - RTL to C Reverse Engineering
Lecture 34 - Phase-wise Verification of HLS
Lecture 35 - Equivalence between C and RTL
Lecture 36 - HLS for Security
Lecture 37 - Introduction to Hardware Security
Lecture 38 - Attacks on RTL Logic locking
Lecture 39 - Introduction to Logic Synthesis
Lecture 40 - FPGA Technology Mapping
Lecture 41 - Introduction to Physical Synthesis
Lecture 42 - Introduction to Circuit optimizations
Lecture 43 - Recent Advances in C-Based VLSI Design
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NPTEL Video Course - Computer Science and Engineering - NOC:Design and Implementation of Human-Computer Inter

Subject Co-ordinator - Prof. Samit Bhattacharya

Co-ordinating Institute - IIT - Guwahati

Sub-Titles - Available / Unavailable │ MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Interactive Systems
Lecture 2 - Introduction to Usability
Lecture 3 - Engineering for Usability
Lecture 4 - Interactive System Life Cycle
Lecture 5 - Usability Requirements
Lecture 6 - Contexual Inquiry
Lecture 7 - Functional Requirements Specification
Lecture 8 - Case Study on SRS
Lecture 9 - Case Study (Usability Requirement Gathering)
Lecture 10 - Case Study (Other Requirement Gathering)
Lecture 11 - Case Study - Non-Functional Requirements to SRS
Lecture 12 - Introduction to Interface Design
Lecture 13 - Shneiderman's Golden Rules
Lecture 14 - Norman's Principles
Lecture 15 - Prototyping
Lecture 16 - Prototype Evaluation - I
Lecture 17 - Prototype Evaluation - II
Lecture 18 - Case Study on Prototype Evaluation - I
Lecture 19 - Case Study on Prototype Evaluation - II
Lecture 20 - Basics of System Design
Lecture 21 - Data Flow Diagram
Lecture 22 - Entity Relationship Diagram
Lecture 23 - Case Study on DFD and ER
Lecture 24 - Introduction to Object Oriented Design
Lecture 25 - UML
Lecture 26 - UML Case Study
Lecture 27 - Coding Basics
Lecture 28 - Code Testing Basics
Lecture 29 - Review-Based Code Testing

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Lecture 30 - Code Review Case Study
Lecture 31 - Black-Box Testing - I
Lecture 32 - Black-Box Testing - II
Lecture 33 - Black-Box Testing Case Study
Lecture 34 - White-Box Testing
Lecture 35 - White-Box Testing Case Study
Lecture 36 - System Integration and Testing
Lecture 37 - Empirical Usability Evaluation - I
Lecture 38 - Empirical Usability Evaluation - II
Lecture 39 - Experiment Design - I
Lecture 40 - Experiment Design - II
Lecture 41 - Empirical Data Analysis
Lecture 42 - Project Management
Lecture 43 - Note on Agile Development
Lecture 44 - Concluding Remarks
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NPTEL Video Course - Computer Science and Engineering - NOC:Digital Design with Verilog

Subject Co-ordinator - Prof. Chandan Karfa, Prof. Aryabartta Sahu

Co-ordinating Institute - IIT - Guwahati

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to Digital Design with Verilog
Lecture 2 - Switching Algebra
Lecture 3 - Canonical Forms of Switching Functions
Lecture 4 - Number Systems
Lecture 5 - Binary Arithmetic
Lecture 6 - Binary Codes
Lecture 7 - Error Detection and Corrections Codes
Lecture 8 - Minimization of Switching functions-Karnaugh Map
Lecture 9 - Karnaugh Map
Lecture 10 - Minimization of Switching functions-Properties
Lecture 11 - Quine-McCluskey Method
Lecture 12 - Quine-McCluskey Method-Prime Implication Chart
Lecture 13 - ESPRESSO-Heuristic Based Switching Function Minimization
Lecture 14 - Multi-level Logic Minimization
Lecture 15 - Multi-level Logic Minimization-Kernels Extraction
Lecture 16 - Digital Circuits Modelling using Verilog
Lecture 17 - Modelling Techniques in Verilog
Lecture 18 - Behavioral Modelling in Verilog
Lecture 19 - Digital System Design using Verilog
Lecture 20 - Testbench in Verilog
Lecture 21 - Code Conversion, Parity Bit Generator
Lecture 22 - Comparator, Multiplexer
Lecture 23 - Encoder, Decoder
Lecture 24 - Ripple Carry Adder, Carry Look ahead Adder
Lecture 25 - Adder/Subtractor
Lecture 26 - BCD Adder, Multiplier
Lecture 27 - Latch/Storage Design
Lecture 28 - Flipflop Design, Characteristics of Flipflop
Lecture 29 - Flipflop, Register and Memory

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Lecture 30 - Digital Counter
Lecture 31 - Finite State Machine Design and Implementation with many Examples
Lecture 32 - FSM Completeness and Correctness
Lecture 33 - Sync Counter using FSM, Implementation using different FFs and Comparision of types of FSM
Lecture 34 - FSM State Optimization using Row Matching and Partitioning Methods
Lecture 35 - State Optimization using Implication chart and State Encoding
Lecture 36 - RTL Design, Introduction to ASM (Algorithmic State Machine)
Lecture 37 - RTL/ASM Design Examples and Implementation
Lecture 38 - ASM Data Path Inference and Control Path Generation
Lecture 39 - Sequential Multplier the Classic Example of RTL Design
Lecture 40 - Introduction to FPGA and Design Flow
Lecture 41 - Introduction to Electronic Design Automation
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NPTEL Video Course - Computer Science and Engineering - NOC:Parallel Computer Architecture

Subject Co-ordinator - Prof. Hemangee K. Kapoor

Co-ordinating Institute - IIT - Guwahati

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Why do we need parallel architecture ?
Lecture 2 - Multicore Revolution
Lecture 3 - What is Parallel Architecture?
Lecture 4 - Performance and Benchmarking
Lecture 5 - Reporting Results
Lecture 6 - Some Laws
Lecture 7 - A shift from sequential to parallel
Lecture 8 - Programming Models
Lecture 9 - Shared Memory Paradigm
Lecture 10 - Message Passing Paradigm
Lecture 11 - Examples
Lecture 12 - Cache Basics
Lecture 13 - Memory hierarchy questions - 1
Lecture 14 - Memory hierarchy questions - 2
Lecture 15 - Six basic cache optimisations - 1
Lecture 16 - Six basic cache optimisations - 2
Lecture 17 - Virtual Memory - 1
Lecture 18 - Virtual Memory - 2
Lecture 19 - Cache Coherence Problem
Lecture 20 - Concept of Serialisation
Lecture 21 - Coherence related Conditions
Lecture 22 - Types of Coherence Protocols - 1
Lecture 23 - Types of Coherence Protocols - 2
Lecture 24 - VI Protocol
Lecture 25 - 3 State: MSI Protocol
Lecture 26 - MESI Protocol
Lecture 27 - Dragon Protocol
Lecture 28 - Coherence misses
Lecture 29 - Coherence misses example

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Lecture 30 - Correctness Requirements
Lecture 31 - Single-Level caches with an Atomic Bus - 1
Lecture 32 - Single-Level caches with an Atomic Bus - 2
Lecture 33 - Multi-Level caches with an Atomic Bus - 1
Lecture 34 - Multi-Level caches with an Atomic Bus - 2
Lecture 35 - Split transaction Bus
Lecture 36 - Phases in Split Transaction Bus
Lecture 37 - Request table and Organization
Lecture 38 - Path of a Cache Miss
Lecture 39 - Multi-Level cache + Split transaction Bus
Lecture 40 - Introduction to Directory Cache Coherence
Lecture 41 - Basic Operation of a Directory
Lecture 42 - Directory Organisations
Lecture 43 - Directory Overhead Optimisations
Lecture 44 - Directory Protocol optimisations
Lecture 45 - Proving Correctness - 1
Lecture 46 - Proving Correctness - 2
Lecture 47 - SGI Origin Architecture
Lecture 48 - Working of protocol
Lecture 49 - Correctness Issues
Lecture 50 - Sequent NUMA-Q Architecture
Lecture 51 - Working of protocol - 1
Lecture 52 - Working of protocol - 2
Lecture 53 - Correctness and Protocol Interaction
Lecture 54 - Sequential Consistency
Lecture 55 - Implications of Sequential Consistency
Lecture 56 - Relaxed Consistency Models - 1
Lecture 57 - Relaxed Consistency Models - 2
Lecture 58 - Relaxing all Orders
Lecture 59 - Uninterruptible Instructions
Lecture 60 - Implementation of atomic instructions
Lecture 61 - Other synchronisation options
Lecture 62 - Interconnect Overview
Lecture 63 - Topologies
Lecture 64 - Routing
Lecture 65 - Flow Control
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NPTEL Video Course - Computer Science and Engineering - Computer Algorithms - 2

Subject Co-ordinator - Prof. Shashank K. Mehta

Co-ordinating Institute - IIT - Kanpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Graph_Basics
Lecture 2 - Breadth_First_Search
Lecture 3 - Dijkstra_Algo
Lecture 4 - All Pair Shortest Path
Lecture 5 - Matriods
Lecture 6 - Minimum Spanning Tree
Lecture 7 - Edmond's Matching Algo I
Lecture 8 - Edmond's Matching Algo II
Lecture 9 - Flow Networks
Lecture 10 - Ford Fulkerson Method
Lecture 11 - Edmond Karp Algo
Lecture 12 - Matrix Inversion
Lecture 13 - Matrix Decomposition
Lecture 14 - Knuth Morris Pratt Algo
Lecture 15 - Rabin Karp Algo
Lecture 16 - NFA Simulation
Lecture 17 - Integer-Polynomial Ops-I
Lecture 18 - Integer-Polynomial Ops-II
Lecture 19 - Integer-Polynomial Ops-III
Lecture 20 - Chinese Remainder-I
Lecture 21 - Chinese Remainder-II
Lecture 22 - Chinese Remainder-III
Lecture 23 - Discrete Fourier Transform-I
Lecture 24 - Discrete Fourier Transform-II
Lecture 25 - Discrete Fourier Transform-III
Lecture 26 - Schonhage Strassen Algo
Lecture 27 - Linear Programming-I
Lecture 28 - Linear Programming-II
Lecture 29 - Geometry-I

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Lecture 30 - Geometry-II
Lecture 31 - Geometry-III
Lecture 32 - Approximation Algo-I
Lecture 33 - Approximation Algo-II
Lecture 34 - Approximation Algo-III
Lecture 35 - General
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NPTEL Video Course - Computer Science and Engineering - Theory of Computation

Subject Co-ordinator - Prof. Somenath Biswas

Co-ordinating Institute - IIT - Kanpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - What is theory of computation? Set membership problem, basic notions like alphabet, strings, form
Lecture 2 - Introduction to finite automaton
Lecture 3 - Finite automata continued, deterministic finite automata(DFAs), language accepted by a DFA
Lecture 4 - Regular languages, their closure properties
Lecture 5 - DFAs solve set membership problems in linear time, pumping lemma
Lecture 6 - More examples of nonregular languages, proof of pumping lemma, pumping lemma as a game, converse
Lecture 7 - A generalization of pumping lemma, nondeterministic finite automata (NFAs), computation trees for
Lecture 8 - Formal description of NFA, language accepted by NFA, such languages are also regular
Lecture 9 - 'Guess and verify' paradigm for nondeterminism
Lecture 10 - NFA's with epsilon transitions
Lecture 11 - Regular expressions, they denote regular languages
Lecture 12 - Construction of a regular expression for a language given a DFA accepting it. Algebraic closure
Lecture 13 - Closure properties (Continued...)
Lecture 14 - Closure under reversal, use of closure properties
Lecture 15 - Decision problems for regular languages
Lecture 16 - About minimization of states of DFAs. Myhill-Nerode theorem
Lecture 17 - Continuation of proof of Myhill-Nerode theorem
Lecture 18 - Application of Myhill-Nerode theorem. DFA minimization
Lecture 19 - DFA minimization (Continued...)
Lecture 20 - Introduction to context free languages (cfls) and context free grammars (cfgs). Derivation of st
Lecture 21 - Languages generated by a cfg, leftmost derivation, more examples of cfgs and cfls
Lecture 22 - Parse trees, inductive proof that L is L(G). All regular languages are context free
Lecture 23 - Towards Chomsky normal forms
Lecture 24 - Simplification of cfgs continued, Removal of epsilon productions
Lecture 25 - Elimination of unit productions. Converting a cfg into Chomsky normal form. Towards pumping lemm
Lecture 26 - Pumping lemma for cfls. Adversarial paradigm
Lecture 27 - Completion of pumping lemma proof. Examples of use of pumping lemma. Converse of lemma does not
Lecture 28 - Closure properties continued. cfls not closed under complementation
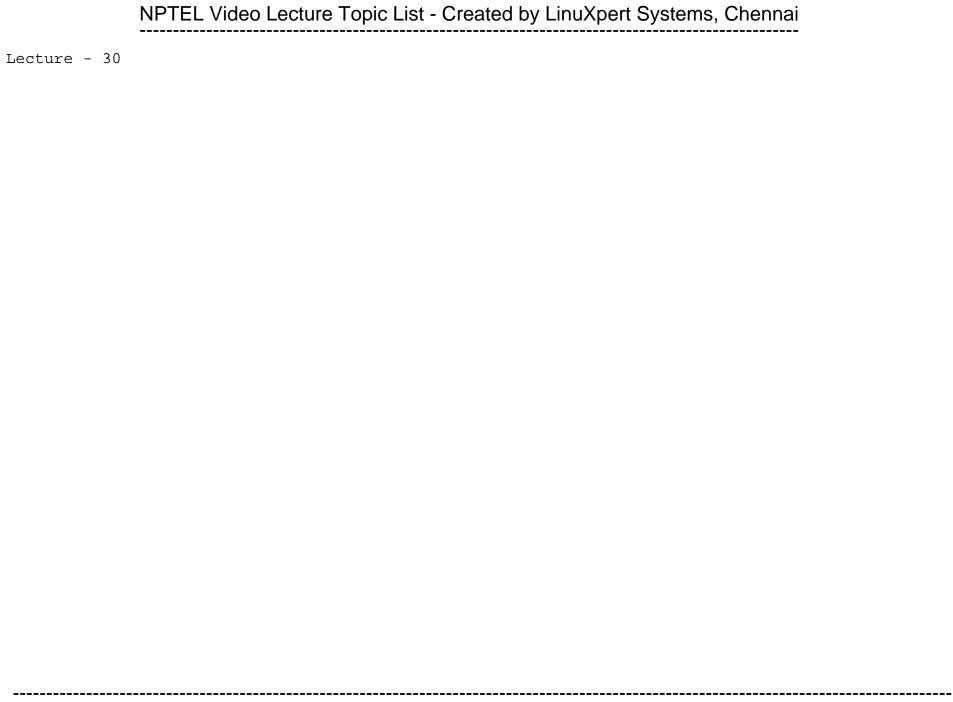Lecture 29 - Another example of a cfl whose complement is not a cfl. Decision problems for cfls

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Lecture 30 - More decision problems. CYK algorithm for membership decision
Lecture 31 - Introduction to pushdown automata (pda)
Lecture 32 - pda configurations, acceptance notions for pdas. Transition diagrams for pdas
Lecture 33 - Equivalence of acceptance by empty stack and acceptance by  final state
Lecture 34 - Turing machines (TM)
Lecture 35 - Execution trace, another example (unary to binary conversion)
Lecture 36 - Example continued. Finiteness of TM description, TM configuration, language acceptance, definiti
Lecture 37 - Notion of non-acceptance or rejection of a string by a TM. Multitrack TM, its equivalence to sta
Lecture 38 - Simulation of multitape TMs by basic model. Nondeterministic TM (NDTM). Equivalence of NDTMs wit
Lecture 39 - Counter machines and their equivalence to basic TM model
Lecture 40 - TMs can simulate computers, diagonalization proof
Lecture 41 - Existence of non-r.e. languages, recursive languages, notion of decidability
Lecture 42 - Separation of recursive and r.e. classes, halting problem and its undecidability
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NPTEL Video Course - Computer Science and Engineering - Introduction to Problem Solving and Programming

Subject Co-ordinator - Prof. D. Gupta

Co-ordinating Institute - IIT - Kanpur

Sub-Titles - Available / Unavailable │ MP3 Audio Lectures - Available / Unavailable

Lecture 1
Lecture 2
Lecture 3
Lecture 4
Lecture 5
Lecture 6
Lecture 7
Lecture 8
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Lecture 10
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Lecture 21
Lecture 22
Lecture 23
Lecture 24

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NPTEL Video Course - Computer Science and Engineering - Riemann Hypothesis and its Applications

Subject Co-ordinator - Prof. Manindra Agrawal

Co-ordinating Institute - IIT - Kanpur

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Lecture - 1
Lecture - 2
Lecture - 3
Lecture - 4
Lecture - 5
Lecture - 6
Lecture - 7
Lecture - 8
Lecture - 9
Lecture - 10
Lecture - 11
Lecture - 12
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Lecture - 29

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Lecture - 30

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NPTEL Video Course - Computer Science and Engineering - Biometrics

Subject Co-ordinator - Prof. Phalguni Gupta

Co-ordinating Institute - IIT - Kanpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Biometrics
Lecture 2 - Biometrics
Lecture 3 - Biometrics
Lecture 4 - Biometrics
Lecture 5 - Biometrics
Lecture 6 - Biometrics
Lecture 7 - Biometrics
Lecture 8 - Biometrics
Lecture 9 - Biometrics
Lecture 10 - Biometrics
Lecture 11 - Biometrics
Lecture 12 - Biometrics
Lecture 13 - Biometrics
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Lecture 24 - Biometrics
Lecture 25 - Biometrics
Lecture 26 - Biometrics

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NPTEL Video Course - Computer Science and Engineering - Parallel Algorithm

Subject Co-ordinator - Prof. Phalguni Gupta

Co-ordinating Institute - IIT - Kanpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Parallel Algorithm
Lecture 2 - Parallel Algorithm
Lecture 3 - Parallel Algorithm
Lecture 4 - Parallel Algorithm
Lecture 5 - Parallel Algorithm
Lecture 6 - Parallel Algorithm
Lecture 7 - Parallel Algorithm
Lecture 8 - Parallel Algorithm
Lecture 9 - Parallel Algorithm
Lecture 10 - Parallel Algorithm
Lecture 11 - Parallel Algorithm
Lecture 12 - Parallel Algorithm
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Lecture 24 - Parallel Algorithm
Lecture 25 - Parallel Algorithm

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NPTEL Video Course - Computer Science and Engineering - Computer Architecture (Dr. Mainak Chaudhuri)

Subject Co-ordinator - Dr. Mainak Chaudhuri

Co-ordinating Institute - IIT - Kanpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction, Amdahl's law, CPI equation
Lecture 2 - CPI equation, research practices, instruction set architecture
Lecture 3 - Instruction set architecture
Lecture 4 - Instruction set architecture
Lecture 5 - Instruction set architecture, case study with MIPS-I
Lecture 6 - Case study with MIPS-I
Lecture 7 - Case study with MIPS-I
Lecture 8 - Binary instrumentation for architectural studies
Lecture 9 - Binary instrumentation for architectural studies
Lecture 10 - Basic pipelining, branch prediction
Lecture 11 - Basic pipelining, branch prediction
Lecture 12 - Basic pipelining, branch prediction
Lecture 13 - Basic pipelining, branch prediction
Lecture 14 - Basic pipelining, branch prediction
Lecture 15 - Basic pipelining, branch prediction
Lecture 16 - Basic pipelining, branch prediction
Lecture 17 - Basic pipelining, branch prediction
Lecture 18 - Basic pipelining, branch prediction
Lecture 19 - Basic pipelining, branch prediction
Lecture 20 - Dynamic scheduling, speculative execution
Lecture 21 - Dynamic scheduling, speculative execution
Lecture 22 - Dynamic scheduling, speculative execution
Lecture 23 - Dynamic scheduling, speculative execution
Lecture 24 - Dynamic scheduling, speculative execution
Lecture 25 - Virtual memory and caches
Lecture 26 - Virtual memory and caches
Lecture 27 - Virtual memory and caches
Lecture 28 - Topics in memory system, DRAM and SRAM technology
Lecture 29 - Topics in memory system, DRAM and SRAM technology

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Lecture 30 - Topics in memory system, DRAM and SRAM technology
Lecture 31 - Case study
Lecture 32 - Case study
Lecture 33 - Case study
Lecture 34 - Case study
Lecture 35 - Input/Output
Lecture 36 - Simultaneous multithreading, multi-cores
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NPTEL Video Course - Computer Science and Engineering - Compiler Design (Prof. Sanjeev K Aggarwal)

Subject Co-ordinator - Prof. Sanjeev K Aggarwal

Co-ordinating Institute - IIT - Kanpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Compiler Design
Lecture 2 - Compiler Design
Lecture 3 - Compiler Design
Lecture 4 - Compiler Design
Lecture 5 - Compiler Design
Lecture 6 - Compiler Design
Lecture 7 - Compiler Design
Lecture 8 - Compiler Design
Lecture 9 - Compiler Design
Lecture 10 - Compiler Design
Lecture 11 - Compiler Design
Lecture 12 - Compiler Design
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Lecture 27 - Compiler Design
Lecture 28 - Compiler Design
Lecture 29 - Compiler Design
Lecture 30 - Compiler Design

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NPTEL Video Course - Computer Science and Engineering - NOC:Introduction to programming in C

Subject Co-ordinator - Prof. Satyadev Nandakumar

Co-ordinating Institute - IIT - Kanpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable


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Lecture 1 - Intro - Process of programming
Lecture 2 - Intro - GCD
Lecture 3 - Intro - Programming cycle
Lecture 4 - Intro - Tracing a simple program
Lecture 5 - Intro - Variables
Lecture 6 - Intro - Operators
Lecture 7 - Loops - While
Lecture 8 - Loops - While example
Lecture 9 - Loops - While GCD example
Lecture 10 - Loops - Longest 1
Lecture 11 - Loops - Longest 2
Lecture 12 - Loops - Longest 3
Lecture 13 - Loops - Do-while
Lecture 14 - Loops - Matrix using nested loops
Lecture 15 - Loops - For
Lecture 16 - Loops - Matrix using nested for loops
Lecture 17 - Loops - Break statement
Lecture 18 - Loops - Continue statement
Lecture 19 - Loops - Continue statement example
Lecture 20 - Data types in C
Lecture 21 - ASCII code
Lecture 22 - Operators Expressions Associativity
Lecture 23 - Precedence of operators
Lecture 24 - Expression evaluation
Lecture 25 - Functions - Introduction
Lecture 26 - Functions - How functions are executed
Lecture 27 - Functions - Examples - 1
Lecture 28 - Functions - Examples - 2
Lecture 29 - Arrays in C
```

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Lecture 30 - Initializing arrays
Lecture 31 - Initializing character arrays
Lecture 32 - Pointers in C
Lecture 33 - Pointer arithmetic
Lecture 34 - Function with pointer arguments
Lecture 35 - Example - copy a subarray
Lecture 36 - Programming using arrays and pointers
Lecture 37 - Sizeof operator
Lecture 38 - Returning pointers from functions
Lecture 39 - Example - return duplicate of a string
Lecture 40 - Recursion - Linear Recursion
Lecture 41 - Recursion - Linear Recursion - 2
Lecture 42 - Recursion - Two-way Recursion
Lecture 43 - Multidimensional Arrays
Lecture 44 - Multidimensional Arrays and Pointers
Lecture 45 - Multidimensional Arrays and Pointers - continued (2)
Lecture 46 - Multidimensional Arrays and Pointers - continued (3)
Lecture 47 - File Handling
Lecture 48 - Some other file-handling functions
Lecture 49 - Structures in C - 1
Lecture 50 - Structures in C - 2
Lecture 51 - Singly Linked Lists
Lecture 52 - Doubly Linked Lists - introduction
Lecture 53 - Organizing code into multiple files - 1
Lecture 54 - Organizing code into multiple files - 2
Lecture 55 - Pre and post increment
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NPTEL Video Course - Computer Science and Engineering - NOC:Fundamentals of Database Systems

Subject Co-ordinator - Dr. Arnab Bhattacharya

Co-ordinating Institute - IIT - Kanpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to Databases
Lecture 2 - Relational Data Model
Lecture 3 - Relational Algebra Basic Operators
Lecture 4 - Relational Algebra Composition of Operators
Lecture 5 - Relational Algebra Additional Operators
Lecture 6 - Relational Algebra Extended Relational Algebra
Lecture 7 - Relational Algebra
Lecture 8 - SQL
Lecture 9 - SQL
Lecture 10 - SQL
Lecture 11 - SQL
Lecture 12 - Normalization Theory
Lecture 13 - Normalization Theory
Lecture 14 - Normalization Theory
Lecture 15 - Normalization Theory
Lecture 16 - Normalization Theory
Lecture 17 - Physical Design
Lecture 18 - Database Indexing
Lecture 19 - Database Indexing
Lecture 20 - Query Processing
Lecture 21 - Query Processing
Lecture 22 - Query Processing
Lecture 23 - Query Processing
Lecture 24 - Query Optimization
Lecture 25 - Query Optimization
Lecture 26 - Query Optimization
Lecture 27 - Query Optimization
Lecture 28 - Database Transactions
Lecture 29 - Database Transactions

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Lecture 30 - Recovery Systems
Lecture 31 - Recovery Systems
Lecture 32 - Recovery Systems
Lecture 33 - Schedules
Lecture 34 - Schedules
Lecture 35 - Schedules
Lecture 36 - Schedules
Lecture 37 - Schedules
Lecture 38 - Concurrency Control
Lecture 39 - Concurrency Control
Lecture 40 - Concurrency Control
Lecture 41 - Concurrency Control
Lecture 42 - Concurrency Control
Lecture 43 - Concurrency Control
Lecture 44 - Concurrency Control
Lecture 45 - NoSQL
Lecture 46 - NoSQL
Lecture 47 - NoSQL
Lecture 48 - Big Data
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NPTEL Video Course - Computer Science and Engineering - NOC:Theory of Computation

Subject Co-ordinator - Prof. Raghunath Tewari

Co-ordinating Institute - IIT - Kanpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to Finite Automata
Lecture 2 - Basic Notation and Convention, DFA Edit Lesson
Lecture 3 - Example of DFAs
Lecture 4 - Computation by DFA and Regular operation
Lecture 5 - Introduction to Nondeterminism
Lecture 6 - NFA, definition and examples
Lecture 7 - Equivalence of NFA and DFA, Closure properties
Lecture 8 - Regular expressions
Lecture 9 - Algebraic properties, RE to NFA conversion
Lecture 10 - GNFA to RE conversion
Lecture 11 - More closure properties of regular languages
Lecture 12 - Non-regular languages and pumping lemma
Lecture 13 - Examples of non-regular languages
Lecture 14 - DFA minimization
Lecture 15 - Introduction to CFGs
Lecture 16 - Examples of CFGs, Reg subset of CFL
Lecture 17 - Parse tree, derivation, ambiguity
Lecture 18 - Normal forms, Chomsky normal form
Lecture 19 - Non-CFLs, pumping lemma
Lecture 20 - Examples of non- CFLs
Lecture 21 - Pushdown Automata
Lecture 22 - Pushdown Automata - Definition and Example
Lecture 23 - Pushdown Automata - Examples and Relation with CFGs
Lecture 24 - Closure Properties of CFLs
Lecture 25 - Deterministic Context Free Languages
Lecture 26 - Turing Machine
Lecture 27 - More on Turing Machine
Lecture 28 - Non deterministic Turing Machine Edit Lesson
Lecture 29 - Configuration Graphs

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Lecture 30 - Closure Properties of Decidable and Turing recognizable languages
Lecture 31 - Decidability properties of Regular and Context Free Languages
Lecture 32 - Undecidability
Lecture 33 - More on Undecidability
Lecture 34 - Reduction
Lecture 35 - Applications of Reduction
Lecture 36 - Rice's theorem
Lecture 37 - Introduction to Computational Complexity Theory
Lecture 38 - More on the class NP
Lecture 39 - NP-Completeness
Lecture 40 - More on NP-Completeness
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NPTEL Video Course - Computer Science and Engineering - NOC:Modern Algebra

Subject Co-ordinator - Prof. Manindra Agrawal

Co-ordinating Institute - IIT - Kanpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Groups
Lecture 2 - Groups
Lecture 3 - Groups
Lecture 4 - Groups
Lecture 5 - Groups
Lecture 6 - Groups
Lecture 7 - Rings
Lecture 8 - Rings
Lecture 9 - Rings
Lecture 10 - Rings
Lecture 11 - Rings
Lecture 12 - Rings
Lecture 13 - Rings
Lecture 14 - Fields
Lecture 15 - Cauchy sequences and real numbers
Lecture 16 - Properties of Fields
Lecture 17 - Finite Fields
Lecture 18 - Application of Fields

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NPTEL Video Course - Computer Science and Engineering - NOC:Advanced Graph Theory

Subject Co-ordinator - Dr.Rajiv Misra

Co-ordinating Institute - IIT - Patna

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Graph Theory
Lecture 2 - Paths, Cycles and Trails
Lecture 3 - Eulerian Circuits, Vertex Degrees and Counting
Lecture 4 - The Chinese Postman Problem and Graphic Sequences
Lecture 5 - Trees and Distance
Lecture 6 - Spanning Trees and Enumeration
Lecture 7 - Matchings and Covers
Lecture 8 - Independent Sets, Covers and Maximum Bipartite Matching
Lecture 9 - Weighted Bipartite Matching
Lecture 10 - Stable Matchings and Faster Bipartite Matching
Lecture 11 - Factors and Perfect Matching in General Graphs
Lecture 12 - Matching in General Graphs
Lecture 13 - Connectivity and Paths
Lecture 14 - k-Connected Graphs
Lecture 15 - Network Flow Problems
Lecture 16 - Vertex Coloring and Upper Bounds
Lecture 17 - Brooksâ Theorem and Color-Critical Graphs
Lecture 18 - Counting Proper Colorings
Lecture 19 - Planar Graphs
Lecture 20 - Characterization of Planar Graphs
Lecture 21 - Line Graphs and Edge-coloring
Lecture 22 - Hamiltonian Graph, Traveling Salesman Problem and NP-Completeness
Lecture 23 - Connected Dominating Set and Distributed Algorithm

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NPTEL Video Course - Computer Science and Engineering - NOC:Cloud Computing and Distributed Systems

Subject Co-ordinator - Dr.Rajiv Misra

Co-ordinating Institute - IIT - Kanpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to Cloud Computing
Lecture 2 - Virtualization
Lecture 3 - Hotspot Mitigation for Virtual Machine Migration
Lecture 4 - Server Virtualization
Lecture 5 - Software Defined Network
Lecture 6 - Geo-distributed Cloud Data Centers
Lecture 7 - Leader Election in Rings (Classical Distributed Algorithms)
Lecture 8 - Leader Election (Ring LE and Bully LE Algorithm)
Lecture 9 - Design of Zookeeper
Lecture 10 - Time and Clock Synchronization in Cloud Data Centers
Lecture 11 - Global State and Snapshot Recording Algorithms
Lecture 12 - Distributed Mutual Exclusion
Lecture 13 - Consensus in Cloud Computing and Paxos
Lecture 14 - Byzantine Agreement
Lecture 15 - Failures and Recovery Approaches in Distributed Systems
Lecture 16 - Design of Key-Value Stores
Lecture 17 - Design of HBase
Lecture 18 - Peer to Peer Systems in Cloud Computing
Lecture 19 - MapReduce
Lecture 20 - Introduction to Spark
Lecture 21 - Introduction to Kafka

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NPTEL Video Course - Computer Science and Engineering - NOC:Big Data Computing

Subject Co-ordinator - Dr. Rajiv Misra

Co-ordinating Institute - IIT - Patna

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to Big Data
Lecture 2 - Big Data Enabling Technologies
Lecture 3 - Hadoop Stack for Big Data
Lecture 4 - Hadoop Distributed File System (HDFS)
Lecture 5 - Hadoop MapReduce 1.0
Lecture 6 - Hadoop MapReduce 2.0 - Part I
Lecture 7 - Hadoop MapReduce 2.0 - Part II
Lecture 8 - MapReduce Examples
Lecture 9 - Parallel Programming with Spark
Lecture 10 - Introduction to Spark
Lecture 11 - Spark Built-in Libraries
Lecture 12 - Design of Key-Value Stores
Lecture 13 - Data Placement Strategies
Lecture 14 - CAP Theorem
Lecture 15 - Consistency Solutions
Lecture 16 - Design of Zookeeper
Lecture 17 - CQL (Cassandra Query Language)
Lecture 18 - Design of HBase
Lecture 19 - Spark Streaming and Sliding Window Analytics - Part I
Lecture 20 - Spark Streaming and Sliding Window Analytics - Part II
Lecture 21 - Sliding Window Analytics
Lecture 22 - Introduction to Kafka
Lecture 23 - Big Data Machine Learning - Part I
Lecture 24 - Big Data Machine Learning - Part II
Lecture 25 - Machine Learning Algorithm K-means using Map Reduce for Big Data Analytics
Lecture 26 - Parallel K-means using Map Reduce on Big Data Cluster Analysis
Lecture 27 - Decision Trees for Big Data Analytics
Lecture 28 - Big Data Predictive Analytics - Part I
Lecture 29 - Big Data Predictive Analytics - Part II

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Lecture 30 - Parameter Servers
Lecture 31 - PageRank Algorithm in Big Data
Lecture 32 - Spark GraphX and Graph Analytics - Part I
Lecture 33 - Spark GraphX and Graph Analytics - Part II
Lecture 34 - Case Study
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NPTEL Video Course - Computer Science and Engineering - NOC:Introduction to Blockchain Technology and Applica

Subject Co-ordinator - Prof. Sandeep Shukla

Co-ordinating Institute - IIT - Kanpur

Sub-Titles - Available / Unavailable │ MP3 Audio Lectures - Available / Unavailable

Lecture 1
Lecture 2
Lecture 3
Lecture 4
Lecture 5
Lecture 6
Lecture 7
Lecture 8
Lecture 9
Lecture 10
Lecture 11
Lecture 12
Lecture 13
Lecture 14
Lecture 15
Lecture 16
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Lecture 19
Lecture 20
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Lecture 24
Lecture 25
Lecture 26
Lecture 27
Lecture 28
Lecture 29

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NPTEL Video Course - Computer Science and Engineering - NOC:Arithmetic Circuit Complexity

Subject Co-ordinator - Prof. Nitin Saxena

Co-ordinating Institute - IIT - Kanpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Turing Machines and Introduction to Arithmetic Circuits
Lecture 2 - Arithmetic complexity classes
Lecture 3 - Determinant is in VP
Lecture 4 - Determinant vs Arithmetic Branching Programs (ABP)
Lecture 5 - Determinant as signed sum of clow sequence
Lecture 6 - Determinant has small ABP and Strassen's homogenization
Lecture 7 - Depth reduction for arithmetic formulas
Lecture 8 - Depth reduction for arithmetic circuits
Lecture 9 - Depth 4 reduction
Lecture 10 - Depth 3 reduction
Lecture 11 - Equivalence of Formulas and Width 3 ABP
Lecture 12 - Width-2 ABP Chasm
Lecture 13 - Grigoriev-Karpinski Measure
Lecture 14 - Lower Bound of Depth-3 circuit over finite fields
Lecture 15 - Lower Bound for depth 3 Multilinear Circuits
Lecture 16 - Lower Bound for Constant depth Multilinear Circuits
Lecture 17 - Structural lemma for constant depth multilinear circuits
Lecture 18 - Extending the proof for multilinear formulas
Lecture 19 - Shifted Partial Derivative Measure
Lecture 20 - Exponential Lower Bound for General depth-4 CIrcuits
Lecture 21 - Lower Bound on Homogeneous Depth-4 circuits
Lecture 22 - Introduction to PIT
Lecture 23 - Hitting Set and Hitting Set Generator
Lecture 24 - PIT vs Lower Bounds

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NPTEL Video Course - Computer Science and Engineering - NOC:Computational Complexity Theory

Subject Co-ordinator - Prof. Raghunath Tewari

Co-ordinating Institute - IIT - Kanpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction
Lecture 2 - NP Completeness
Lecture 3 - SAT is NP-complete
Lecture 4 - More on NP completeness
Lecture 5 - Hierarchy Theorems
Lecture 6 - Introduction to Space Complexity
Lecture 7 - Savitchâ s Theorem
Lecture 8 - Immerman-Szelepscenyi Theorem
Lecture 9 - Polynomial Hierarchy
Lecture 10 - A PSPACE Complete Problem
Lecture 11 - More on Polynomial Hierarchy
Lecture 12 - Alternating Turing Machines
Lecture 13 - Equivalence of Quantifier and Oracle Based Definitions of Polynomial Hierarchy
Lecture 14 - Boolean Circuits
Lecture 15 - Shannonâ s Theorem and Karp-Lipton-Sipser Theorem
Lecture 16 - Bounded Depth Circuit Classes
Lecture 17 - Kannanâ s Theorem
Lecture 18 - Probabilistic Complexity
Lecture 19 - StrongBPP and WeakBPP
Lecture 20 - One-sided and Zero-sided Error Probabilistic Complexity Classes
Lecture 21 - Error Reduction for BPP
Lecture 22 - BPP in PH and Logspace Randomized Classes
Lecture 23 - Valiant-Vazirani Theorem - I
Lecture 24 - Valiant-Vazirani Theorem - II
Lecture 25 - Amplified version of Valiant-Vazirani Theorem
Lecture 26 - Todaâ s Theorem - I
Lecture 27 - Todaâ s Theorem - II
Lecture 28 - Permanent and Determinant Functions
Lecture 29 - Permanent is hard for #P

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Lecture 30 - Interactive Proofs
Lecture 31 - Graph Non-Isomorphism is in IP[2]
Lecture 32 - Set Lower Bound Protocol
Lecture 33 - MA is in AM
Lecture 34 - Sumcheck Protocol - I
Lecture 35 - Sumcheck Protocol - II
Lecture 36 - Parity not in AC0 - I
Lecture 37 - Parity not in AC0 - II
Lecture 38 - Circuits with Counters
Lecture 39 - Communication Complexity - I
Lecture 40 - PCP Theorem
Lecture 41 - Communication Complexity - II
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NPTEL Video Course - Computer Science and Engineering - NOC:Randomized Methods in Complexity

Subject Co-ordinator - Prof. Nitin Saxena

Co-ordinating Institute - IIT - Kanpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Course Outline
Lecture 2 - Circuits and Polynomial Identity Testing
Lecture 3 - Derandomization and Lower Bounds
Lecture 4 - IP=PSPACE
Lecture 5 - ACC0 Lower Bounds
Lecture 6 - ACC0 Lower Bounds (Continued...)
Lecture 7 - Monotone Circuits
Lecture 8 - Monotone Circuit Lower Bound and Sunflower Lemma
Lecture 9 - Undirected Graph Connectivity in randomized logspace
Lecture 10 - Graph Expansion Properties
Lecture 11 - Expanders
Lecture 12 - Error Reduction using Expanders
Lecture 13 - Ajtai-Komlos-Szemeredi Theorem
Lecture 14 - Explicit construction of expanders and Zig-Zag product
Lecture 15 - Spectral analysis of Zig-Zag product
Lecture 16 - Undirected Path in logspace
Lecture 17 - Explicit Prg to derandomizing classes
Lecture 18 - Hardness vs Randomness
Lecture 19 - Hardness to NW-Generator to PRG
Lecture 20 - Partial derandomization from worst-case hardness of permanent
Lecture 21 - Error-correcting codes
Lecture 22 - Introduction to various linear explicit codes
Lecture 23 - Introduction of efficient decoding
Lecture 24 - Local decoding of WH, Reed-Muller and Concatenated codes
Lecture 25 - Introduction to List Decoding
Lecture 26 - Local List decoding of WH, RM

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NPTEL Video Course - Computer Science and Engineering - NOC:Probability for Computer Science

Subject Co-ordinator - Prof. Nitin Saxena

Co-ordinating Institute - IIT - Kanpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introductory examples
Lecture 2 - Examples and Course outline
Lecture 3 - Probability over discrete space
Lecture 4 - Inclusion-Exclusion principle
Lecture 5 - Probability over infinite space
Lecture 6 - Conditional probability, Partition formula
Lecture 7 - Independent events, Bayes theorem
Lecture 8 - Fallacies, Random variables
Lecture 9 - Expection
Lecture 10 - Conditional Expectation
Lecture 11 - Important Random Variables
Lecture 12 - Continuous Random Variables
Lecture 13 - Equality Checking, Poisson Distribution
Lecture 14 - Concentration Inequivalities, Variance
Lecture 15 - Weak Linearity of Variance, Law of Large Numbers
Lecture 16 - Chernoff's Bound. K-wise Independence
Lecture 17 - Union and Factorial Estimates
Lecture 18 - Stochastic Process: Markov Chains
Lecture 19 - Drunkard's walk, Evolution of Markov Chains
Lecture 20 - Stationary Distribution
Lecture 21 - Perron-Frobenius Theorem, Page Rank Algorithm
Lecture 22 - Page Rank Algorithm: Ergodicity
Lecture 23 - Cell Genetics
Lecture 24 - Random Sampling
Lecture 25 - Biased Coin Tosses, Hashing
Lecture 26 - Hashing, Introduction to Probabilistic Methods
Lecture 27 - Ramsey Numbers, Large Cuts in Graphcs
Lecture 28 - Sum Free Subsets, Discrepancy
Lecture 29 - Extremal Set Families

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Lecture 30 - Super Concentrators
Lecture 31 - Streaming Algorithms - I
Lecture 32 - Streaming Algorithms - II

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NPTEL Video Course - Computer Science and Engineering - NOC:Circuit Complexity Theory

Subject Co-ordinator - Prof. Raghunath Tewari

Co-ordinating Institute - IIT - Kanpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction
Lecture 2 - Standard Bounds
Lecture 3 - Shannon's Theorem
Lecture 4 - Riordon-Shannon Theorem
Lecture 5 - Khrapchenko's Theorem
Lecture 6 - Proof of Khrapchenko's Theorem
Lecture 7 - Application of Khrapchenko's Theorem
Lecture 8 - Nechiporuk's Theorem
Lecture 9 - Application of Nechiporuk's Theorem
Lecture 10 - Subbotovskaya's Theorem - I
Lecture 11 - Subbotovskaya's Theorem - II
Lecture 12 - Applications of Subbotovskaya's Theorem
Lecture 13 - Upper and Lower Bounds on the Andreev Function
Lecture 14 - Upper and Lower Bounds on the Andreev Function
Lecture 15 - Polynomial Size Monotone Formula for MAJORITY (Valiant's Theorem) - II
Lecture 16 - Circuits for Addition - Ripple Adder and Carry Lookahead Adder
Lecture 17 - Circuits for Addition - Parallel Prefix Sum Method
Lecture 18 - Circuits for Iterated Addition and Multiplication
Lecture 19 - Bounded Depth Circuit Classes
Lecture 20 - Basic Circuit for Division using Newton-Raphson Method
Lecture 21 - Division in NC1 (Beame, Cook, Hoover Theorem) - I
Lecture 22 - Division in NC1 (Beame, Cook, Hoover Theorem) - II
Lecture 23 - Division in NC1 (Beame, Cook, Hoover Theorem) - III
Lecture 24 - Division in NC1 (Beame, Cook, Hoover Theorem) - IV
Lecture 25 - Division in NC1 (Beame, Cook, Hoover Theorem) - V
Lecture 26 - Division in NC1 (Beame, Cook, Hoover Theorem) - VI
Lecture 27 - Relation between Bounded Depth Circuit Classes and Uniform Complexity Classes - I
Lecture 28 - Relation between Bounded Depth Circuit Classes and Uniform Complexity Classes - II
Lecture 29 - Reducing Circuit Depth

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Lecture 30 - P is in P/poly
Lecture 31 - Discussion on Lower Circuit Bounds for Bounded Depth Circuit Classes
Lecture 32 - Monotone Circuit Lower Bound for Clique (Razborov's Theorem) - I
Lecture 33 - Monotone Circuit Lower Bound for Clique (Razborov's Theorem) - II
Lecture 34 - Monotone Circuit Lower Bound for Clique (Razborov's Theorem) - III
Lecture 35 - Monotone Circuit Lower Bound for Clique (Razborov's Theorem) - IV
Lecture 36 - Monotone Circuit Lower Bound for Clique (Razborov's Theorem) - V
Lecture 37 - Monotone Circuit Lower Bound for Clique (Razborov's Theorem) - VI
Lecture 38 - Circuit Lower Bound for Parity by Approximating Circuits using Polynomials (Razborov-Smolensky T
Lecture 39 - Circuit Lower Bound for Parity by Approximating Circuits using Polynomials (Razborov-Smolensky T
Lecture 40 - Circuit Lower Bound for Parity by Approximating Circuits using Polynomials (Razborov-Smolensky T
Lecture 41 - Circuit Lower Bound for Parity using Switching Lemma (Hastad's Theorem)
Lecture 42 - Circuit Lower Bound for Parity using Switching Lemma (Hastad's Theorem)
Lecture 43 - Circuit Lower Bound for Parity using Switching Lemma (Hastad's Theorem)
Lecture 44 - Proof of Hastad's Switching Lemma - I
Lecture 45 - Proof of Hastad's Switching Lemma - II
Lecture 46 - Communication Complexity of a Function
Lecture 47 - Relation Between Communication Complexity and Circuit Depth (Karchmer-Wigderson Theorem) - I
Lecture 48 - Relation Between Communication Complexity and Circuit Depth (Karchmer-Wigderson Theorem) - II
Lecture 49 - Bounded Width Branching Programs = NC1 (Barrington's Theorem) - I
Lecture 50 - Bounded Width Branching Programs = NC1 (Barrington's Theorem) - II
Lecture 51 - Width 3 Branching Programs = MOD3 o MOD2 Circuits (Barrington's Theorem) - I
Lecture 52 - Width 3 Branching Programs = MOD3 o MOD2 Circuits (Barrington's Theorem) - II
Lecture 53 - Uniform AC0 can be simulated by depth 3 Threshold circuits of quasipolynomial size (Allender-Her
Lecture 54 - Uniform AC0 can be simulated by depth 3 Threshold circuits of quasipolynomial size (Allender-Her
Lecture 55 - Valient-Vazirani Theorem - I
Lecture 56 - Valient-Vazirani Theorem - II
Lecture 57 - Natural Proof Barrier (Razborov-Rudich Theorem) - I
Lecture 58 - Natural Proof Barrier (Razborov-Rudich Theorem) - II
Lecture 59 - Pseudorandom Function Generator by Goldreich, Goldwasser and Micali - I
Lecture 60 - Pseudorandom Function Generator by Goldreich, Goldwasser and Micali - II

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NPTEL Video Course - Computer Science and Engineering - NOC:Foundation of Cloud IoT Edge ML

Subject Co-ordinator - Prof. Rajiv Misra

Co-ordinating Institute - IIT - Kanpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to Edge Computing
Lecture 2 - Introduction to Cloud
Lecture 3 - Introduction to IoT Platform
Lecture 4 - Time and Clock Synchronization in IoT
Lecture 5 - Enabling Intelligence at Edge Layer for IoT
Lecture 6 - ML-based Image Classifier at IoT-Edge
Lecture 7 - Introduction to Docker Containers and Kubernetes
Lecture 8 - ML based Predictive Maintenance at IoT Edge
Lecture 9 - Deep Reinforcement Learning for Cloud Edge
Lecture 10 - Deep Reinforcement Learning for Cloud Edge Example
Lecture 11 - Public Cloud Services Case Study of AWS Services
Lecture 12 - Mathematical formulations for task offloading in Edge Cloud
Lecture 13 - Task Offloading Based on LSTM Prediction and Deep Reinforcement Learning
Lecture 14 - Vertical and Horizontal Offloading for Cloud Edge
Lecture 15 - Global State and Snapshot Recording Algorithms
Lecture 16 - Hot Data Analytics for Real Time Streaming in IoT Platform
Lecture 17 - Introduction to MQTT and Kafka in IoT Platform
Lecture 18 - Introduction to Edge Data Center for IoT Platform
Lecture 19 - Design of Key Value Stores for IoT Edge Storage
Lecture 20 - Introduction to Edge ML with AWS IoT platform
Lecture 21 - Introduction to Federated Learning at IoT Edge
Lecture 22 - ML for Autonomous Driving Car

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NPTEL Video Course - Computer Science and Engineering - NOC:Linear Programming and its Applications to Comput

Subject Co-ordinator - Prof. Rajat Mittal

Co-ordinating Institute - IIT - Kanpur

Sub-Titles - Available / Unavailable │ MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Linear Programming, an Example
Lecture 2 - Introduction to Linear Programming
Lecture 3 - Gaussian Elimination with Examples
Lecture 4 - Summary of Gaussian Elimination
Lecture 5 - Vector Space over real numbers
Lecture 6 - Linear Operators
Lecture 7 - Solutions of Linear Equations
Lecture 8 - Resource Allocation as LP
Lecture 9 - Approximate Degree as LP
Lecture 10 - Equivalent LP's
Lecture 11 - Introduction to Convexity
Lecture 12 - Different Kind of Convex Sets
Lecture 13 - Feasible Region of LP
Lecture 14 - Proof of Weyl's Theorem
Lecture 15 - Definition of Convex Functions
Lecture 16 - Properties of Convex Functions and Examples
Lecture 17 - Basic Feasible Solution
Lecture 18 - BFS and Vertices
Lecture 19 - Simplex Algorithm
Lecture 20 - Details of Simplex Algorithm
Lecture 21 - Starting BFS
Lecture 22 - Degeneracy
Lecture 23 - Introduction to Duality
Lecture 24 - Hyperplane Separation Theorems
Lecture 25 - Farkas Lemma
Lecture 26 - How to take dual
Lecture 27 - Examples of taking dual
Lecture 28 - Strong Duality
Lecture 29 - Proof of Strong Duality

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Lecture 30 - Complementary Slackness
Lecture 31 - Introduction to Algorithmic Game Theory
Lecture 32 - Nash Equilibrium
Lecture 33 - Minimax and Nash Equilibrium
Lecture 34 - Deterministic Communication Complexity
Lecture 35 - Randomized Communication Complexity
Lecture 36 - Yao's Minimax Theorem
Lecture 37 - Lower bounds using Yao's Minimax
Lecture 38 - Set Disjointness Problem
Lecture 39 - LP for mass flow problem
Lecture 40 - LP for min cut problem
Lecture 41 - Max flow = Min cut
Lecture 42 - Primal dual approach
Lecture 43 - Primal dual for max flow
Lecture 44 - Set cover problem
Lecture 45 - Rounding for set cover
Lecture 46 - Analysis of Rounding
Lecture 47 - Algorithm for Set Cover
Lecture 48 - Linear Regression through LP
Lecture 49 - Linear Classifiers through LP
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NPTEL Video Course - Computer Science and Engineering - NOC:Basics of Computational Complexity

Subject Co-ordinator - Prof. Nitin Saxena

Co-ordinating Institute - IIT - Kanpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction
Lecture 2 - Outline
Lecture 3 - Formalize Problems and Machines
Lecture 4 - Turing Machine
Lecture 5 - Asymptotics, Church-Turing Thesis and UTM
Lecture 6 - Halting Problem and Diagonalization
Lecture 7 - Classes P, NP, EXP
Lecture 8 - Comparison of Classes and Non-determination
Lecture 9 - NP Vs Ntime
Lecture 10 - SAT is NP-hard
Lecture 11 - Cook-Levin Theorem
Lecture 12 - NP-Hardness and Co-Classes
Lecture 13 - NEXP and Godel's Computation Question
Lecture 14 - Time, Space Hierarchy
Lecture 15 - NDTM Hierarchy
Lecture 16 - Ladner's Theorem and Introduction to Oracles
Lecture 17 - Oracle and Relativizing Proofs
Lecture 18 - Non Relativizing P=NP and Introduction to Space Complexity
Lecture 19 - PSpace Completeness
Lecture 20 - QBF Game and NSpace
Lecture 21 - NL Complete
Lecture 22 - NL = coNL
Lecture 23 - Polynomial Hierarchy
Lecture 24 - Polynomial Hierarchy
Lecture 25 - PH Complete and Oracle TM
Lecture 26 - NP^NP and #SAT
Lecture 27 - Counting Classes #P and PP
Lecture 28 - Permanent and its Cycle cover of a Graph
Lecture 29 - #P-Complete: Graph Gadgets

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Lecture 30 - #P-Hard: Analyse XOR
Lecture 31 - Valient-Vazirani Lemma and Hashing
Lecture 32 - SAT to Parity-SAT
Lecture 33 - Parity Quantification
Lecture 34 - Randomized Reduction of PH to Parity-P
Lecture 35 - PH to #P
Lecture 36 - Probabilistic TM
Lecture 37 - Example of PTM and Introduction to RP and ZPP
Lecture 38 - ZPP = RP and coRP
Lecture 39 - Probability Amplification
Lecture 40 - BPP in PH
Lecture 41 - GNI is in BP.NP
Lecture 42 - GI is NP-hard
Lecture 43 - GI is NP-hard (Continued...) Going Beyond TMs
Lecture 44 - Circuit Complexity
Lecture 45 - TM with Advice - P/poly
Lecture 46 - Circuits for NP and EXP
Lecture 47 - Parallel Computation
Lecture 48 - P-completeness and NEXP-completeness
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NPTEL Video Course - Computer Science and Engineering - NOC:Edge Computing

Subject Co-ordinator - Multi-Faculty

Co-ordinating Institute - IIT - Kanpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Overview of Cloud Computing
Lecture 2 - Cloud Computing and its Limitation to Support Low Latency and RTT
Lecture 3 - Introduction to Edge Computing
Lecture 4 - Edge Computing Paradigms - 004
Lecture 5 - Overview of Virtualization
Lecture 6 - Docker Containers
Lecture 7 - Kubernetes
Lecture 8 - NoSQL Databases and Key Value Stores
Lecture 9 - Edge AI Intelligence at the Edge
Lecture 10 - Edge AI Intelligence at the Edge
Lecture 11 - Mobile Edge Computing
Lecture 12 - Geo-distributed Data Centers
Lecture 13 - Time and Clock Synchronization
Lecture 14 - Edge Computing Security and Privacy
Lecture 15 - Network Virtualization
Lecture 16 - Resource Allocation in Private and Public Edge-Cloud Systems

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NPTEL Video Course - Computer Science and Engineering - NOC:Practical Cyber Security for Cyber Security Pract

Subject Co-ordinator - Prof. Sandeep K. Shukla

Co-ordinating Institute - IIT - Kanpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to the Course - Practical Cyber Security for Cyber Practitioners
Lecture 2 - Introduction to Cyber Kill Chains - Lockheed Martin Kill Chain
Lecture 3 - Understanding Cyber Kill Chain - Delivery, Exploitation, and Installation
Lecture 4 - Mastering the Cyber Kill Chain: Command and Control and Actions on Objectives
Lecture 5 - Introduction to MITRE ATT&CK framework
Lecture 6 - Understanding MITRE ATT&CK: A Guide to Cyber Threat Intelligence
Lecture 7 - Mapping to ATT&CK from Finished Cyber Incident
Lecture 8 - Introduction to Mapping to ATT&CK from Raw Data
Lecture 9 - Mapping to ATT&CK from RAW Data
Lecture 10 - Storing and Analyzing ATT&CK-Mapped Data
Lecture 11 - Making Defensive Recommendations from ATT&CK-Mapped Data
Lecture 12 - TTP Mapping and Introduction to Unified Kill Chain
Lecture 13 - Deep Dive into Unified Kill Chain - Part 1
Lecture 14 - Deep Dive into Unified Kill Chain - Part 2
Lecture 15 - Introduction to MITRE DEF3ND Framework
Lecture 16 - Deep dive into MITRE DEF3ND framework - I
Lecture 17 - Deep dive into MITRE DEF3ND framework - II
Lecture 18 - MITRE DEF3ND Framework Conclusion and Introduction to Risk Identification and Assessment
Lecture 19 - Deep dive into Risk Assessment - I
Lecture 20 - Deep dive into Risk Assessment - II
Lecture 21 - Introduction to Cyber Crisis Management
Lecture 22 - Cyber Crisis Conclusion and Introduction to Cyber Resilience
Lecture 23 - Deep dive into Cyber Resilience - I
Lecture 24 - Deep dive into Cyber Resilience - II
Lecture 25 - Cyber Resilience Review (Self-Assessment)
Lecture 26 - Cyber Threat Intelligence Sharing - STIX Tutorial - Part 1
Lecture 27 - Cyber Threat Intelligence Sharing - STIX Tutorial - Part 2
Lecture 28 - Introduction to SCAP, CVE and CCE
Lecture 29 - Deep Dive into CVE, CCE, CPE, CVSS Scoring, XCCDF, OVAL Languages - Part 1

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Lecture 30
Lecture 31

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NPTEL Video Course - Computer Science and Engineering - NOC:Computational Arithmetic - Geometry for Algebraic

Subject Co-ordinator - Prof. Nitin Saxena

Co-ordinating Institute - IIT - Kanpur

Sub-Titles - Available / Unavailable │ MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Course outline and Fundamentals
Lecture 2 - Ideals and Varieties
Lecture 3 - Dimension of Varieties
Lecture 4 - Projective varieties
Lecture 5 - Morphisms and rational functions
Lecture 6 - Local rings
Lecture 7 - Rational maps and Birationality
Lecture 8 - Tangent space and Singularities
Lecture 9 - Resolution of singularities
Lecture 10 - Discrete valuation rings
Lecture 11 - Existence of nonsingular model
Lecture 12 - Nonsingular curves
Lecture 13 - Divisor on Curves
Lecture 14 - Riemann-Roch Spaces - I
Lecture 15 - Riemann-Roch Spaces - II
Lecture 16 - Divisor Class Group
Lecture 17 - Genus of a curve
Lecture 18 - Riemann-Roch and Adeles
Lecture 19 - Differentials and Riemann-Roch
Lecture 20 - Canonical divisor and proof of Riemann-Roch
Lecture 21 - Jacobian of a curve
Lecture 22 - Zeta function of curves
Lecture 23 - Functional equation and point counting
Lecture 24 - Riemann hypothesis for curves
Lecture 25 - Proof of RH for curves: Galois covers
Lecture 26 - Proof of RH for curves II: Multilinear algebra
Lecture 27 - Cohomological interpretation of zeta function

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NPTEL Video Course - Computer Science and Engineering - NOC:Discrete Mathematics for CS

Subject Co-ordinator - Prof. Nitin Saxena

Co-ordinating Institute - IIT - Kanpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Course Outline
Lecture 2 - Whar are Proofs - I
Lecture 3 - What are Proofs - II
Lecture 4 - What are Proofs - III
Lecture 5 - How to Count - I
Lecture 6 - How to Count - II
Lecture 7 - How to Count - III
Lecture 8 - How to Count - IV and What's Combinatorics - I
Lecture 9 - What's Combinatorics - II
Lecture 10 - What's Combinatorics - III and What are Posets - I
Lecture 11 - What are Posets - II
Lecture 12 - What are Posets - III and What are Graphs - I
Lecture 13 - What are Graphs - II
Lecture 14 - What are Graphs - III
Lecture 15 - What are Graphs - IV
Lecture 16 - What are Graphs - V and Graph Properties - I
Lecture 17 - Graph Properties - II
Lecture 18 - Colorings and Matchings - I
Lecture 19 - Colorings and Matchings - II
Lecture 20 - Colorings and Matchings - III and Properties of Numbers - I
Lecture 21 - Properties of Numbers - II
Lecture 22 - Properties of Numbers - III
Lecture 23 - Properties of Numbers - IV
Lecture 24 - Properties of Numbers - V and Primes and Cryptography - I
Lecture 25 - Primes and Cryptography - II
Lecture 26 - Primes and Cryptography - III and Fields and Applications - I
Lecture 27 - Fields and Applications - II
Lecture 28 - Fields and Applications - III
Lecture 29 - Fields and Applications - IV

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Lecture 30 - Fields and Applications - V
Lecture 31 - Fields and Applications - VI
Lecture 32 - Fields and Applications - VII and What's a Group - I
Lecture 33 - What's a Group - II
Lecture 34 - What's a Group - III
Lecture 35 - Burnside's Lemma and Normal Subgroups
```

NPTEL Video Course - Computer Science and Engineering - NOC:Practical High-Performance Computing

Subject Co-ordinator - Prof. Mahendra Verma

Co-ordinating Institute - IIT - Kanpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to High Performance Computation (Bird's-eye View of Computer Systems)
Lecture 2 - L2 Part A : Basic Design (Bird's-eye View of Computer Systems)
Lecture 3 - L2 Part B : Processors (Bird's-eye View of Computer Systems)
Lecture 4 - L3 Part A : Vectorization (Bird's-eye View of Computer Systems)
Lecture 5 - L3 Part B : Multicore Processors (Bird's-eye View of Computer Systems)
Lecture 6 - L4 Part A : Memory (Basics of Operating System)
Lecture 7 - L4 Part B : Basics of Operating System (Basics of Operating System)
Lecture 8 - L4 Part C : RAM (Basics of Operating System)
Lecture 9 - L4 Part D : Interconnect (Basics of Operating System)
Lecture 10 - L5 Part A : Parallel Computer Classification (Basics of Operating System)
Lecture 11 - L5 Part B : Classes of Parallelism (Basics of Operating System)
Lecture 12 - L5 Part C : Networks (Basics of Operating System)
Lecture 13 - L6 Part A : Top-10 HPC Systems (High Performance Computing (HPC) Clusters)
Lecture 14 - L6 Part B : Using GPUs for HPC (High Performance Computing (HPC) Clusters)
Lecture 15 - L7 Part A : Scaling (High Performance Computing (HPC) Clusters)
Lecture 16 - L7 Part B : Programming Practices (High Performance Computing (HPC) Clusters)
Lecture 17 - L8 Part A : Programming Language (C and Python)
Lecture 18 - L8 Part B : Classes in Python (C and Python)
Lecture 19 - L8 Part C : Inheritance (C and Python)
Lecture 20 - L9 Part A : Modules in Python (C and Python)
Lecture 21 - L9 Part B : Python Pitfalls (C and Python)
Lecture 22 - L9 Part C : Python Arrays (C and Python)
Lecture 23 - L10 Part A : C Arrays 1D (C and Python)
Lecture 24 - L10 Part B : Higher-Dimensional C Arrays (C and Python)
Lecture 25 - L11 Part A : Python Codes Optimization 1 (Programming Paradigm)
Lecture 26 - L11 Part B : C++ Codes Optimization 1 (Programming Paradigm)
Lecture 27 - L12 Part A : Python Codes Optimization 2 (Programming Paradigm)
Lecture 28 - L12 Part B : C++ Codes Optimization 2 (Programming Paradigm)
Lecture 29 - L13 Part A : C++ Codes Optimization 3 (Cache Locality) (Programming Paradigm)

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Lecture 30 - L13 Part B : Speeding up Using Numba (Programming Paradigm)
Lecture 31 - L14 Part A : Finite Difference Method (Multiprocessing and Multithreading)
Lecture 32 - L14 Part B : Particle Simulations (Molecular Dynamics) (Multiprocessing and Multithreading)
Lecture 33 - L14 Part C : Using Multiprocessing Module (Multiprocessing and Multithreading)
Lecture 34 - L15 Part A : Cache Issues in Multiprocessing (Multiprocessing and Multithreading)
Lecture 35 - L15 Part B : Using Multithreading Module (Multiprocessing and Multithreading)
Lecture 36 - L15 Part C : Computing Sum(a*b) with Multithreads (Multiprocessing and Multithreading)
Lecture 37 - L15 Part D : Computing AX=Y with Multithreads (Multiprocessing and Multithreading)
Lecture 38 - L16 Part A : MPI Using Mpi4py (Message Passing Interface - MPI)
Lecture 39 - L16 Part B : Point-to-Point Communication (1) (Message Passing Interface - MPI)
Lecture 40 - L16 Part C : Point-to-Point Communication (2) (Message Passing Interface - MPI)
Lecture 41 - L17 Part A : Unblocking Send/Recv (Message Passing Interface - MPI)
Lecture 42 - L17 Part B : Collective Communication and Reduction Operation (Message Passing Interface - MPI)
Lecture 43 - L17 Part C : Send/Receive for Finite Difference Scheme (Message Passing Interface - MPI)
Lecture 44 - L17 Part D : MPI Sum with Examples (Message Passing Interface - MPI)
Lecture 45 - L18 Part A : Introduction to CUDA Programming (CUDA Programming)
Lecture 46 - L18 Part B : Introduction to C (1) (CUDA Programming)
Lecture 47 - L18 Part C : Introduction to C (2) (CUDA Programming)
Lecture 48 - L18 Part D : CUDA Programming (1) (CUDA Programming)
Lecture 49 - L19 Part A : CUDA Programming (2) (CUDA Programming)
Lecture 50 - L19 Part B : Examples Using CUDA Programming (CUDA Programming)
Lecture 51 - L19 Part C : Matrix Multiplication (CUDA Programming)
Lecture 52 - L19 Part D : Derivative Computation Using Finite Difference (CUDA Programming)
Lecture 53 - L20 Part A : Cupy Programming (Cupy/Numba/OpenACC Programming)
Lecture 54 - L20 Part B : CUDA Programming with Numba (Cupy/Numba/OpenACC Programming)
Lecture 55 - L20 Part C : Introduction to OpenACC Programming 1 (Cupy/Numba/OpenACC Programming)
Lecture 56 - L21 Part A : Introduction to OpenACC Programming 2 (Cupy/Numba/OpenACC Programming)
Lecture 57 - L21 Part B : Solving Laplace Equation / OpenACC UPDATE Directives and Clauses (Cupy/Numba/OpenAC
Lecture 58 - L22 Part A : Introduction to MPI in C (MPI in C)
Lecture 59 - L22 Part B : MPI Environment (MPI in C)
Lecture 60 - L22 Part C : Point to Point Communications (MPI in C)
Lecture 61 - L23 Part A : Collective Communication and Reduction Operation (MPI in C)
Lecture 62 - L23 Part B : Using OPENMP (MPI in C)
Lecture 63 - L24 Part A : FFT (FFT + Profiling + Paraview)
Lecture 64 - L24 Part B : Spectral Method (FFT + Profiling + Paraview)
Lecture 65 - L24 Part C : Profiling (FFT + Profiling + Paraview)
Lecture 66 - L24 Part D : Paraview (FFT + Profiling + Paraview)
Lecture 67 - L25 Part A : Project 1: Cahn-Hilliard Equation (Projects + Summary)
Lecture 68 - L25 Part B : Project 2: Compressible Flow (Projects + Summary)
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Lecture 69 - L25 Part C : Project 3: Ising Model (Projects + Summary)
Lecture 70 - L25 Part D : Project 4: Magnetohydodynamics (Projects + Summary)
Lecture 71 - L25 Part E : Project 5: Molecular Dynamics (Projects + Summary)
Lecture 72 - L25 Part F : Project 6: Nonlinear Shrodinger Equation (Projects + Summary)
Lecture 73 - L25 Part G : Project 7: XY Model (Projects + Summary)
Lecture 74 - L26 : Summary (Projects + Summary)
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NPTEL Video Course - Computer Science and Engineering - Cryptography and Network Security

Subject Co-ordinator - Dr. Debdeep Mukhopadhyay

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction
Lecture 2 - Overview on Modern Cryptography
Lecture 3 - Introduction to Number Theory
Lecture 4 - Probability and Information Theory
Lecture 5 - Classical Cryptosystems
Lecture 6 - Cryptanalysis of Classical Ciphers
Lecture 7 - Shannons Theory
Lecture 8 - Shannons Theory (Continued...1)
Lecture 9 - Shannons Theory (Continued...2)
Lecture 10 - Symmetric Key Ciphers
Lecture 11 - Block Cipher Standards (DES)
Lecture 12 - Block Cipher Standards (AES)
Lecture 13 - Block Cipher Standards (AES) (Continued...)
Lecture 14 - Linear Cryptanalysis
Lecture 15 - Differential Cryptanalysis
Lecture 16 - Few other Cryptanalytic Techniques
Lecture 17 - Overview on S-Box Design Principles
Lecture 18 - Modes of Operation of Block Ciphers
Lecture 19 - Stream Ciphers
Lecture 20 - Stream Ciphers (Continued...1)
Lecture 21 - Stream Ciphers (Continued...2)
Lecture 22 - Pseudorandomness
Lecture 23 - Cryptographic Hash Functions
Lecture 24 - Cryptographic Hash Functions (Continued...1)
Lecture 25 - Cryptographic Hash Functions (Continued...2)
Lecture 26 - Message Authentication Codes
Lecture 27 - More Number Theoretic Results
Lecture 28 - The RSA Cryptosystem
Lecture 29 - Primality Testing

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Lecture 30 - Factoring Algorithms
Lecture 31 - Some Comments on the Security of RSA
Lecture 32 - Discrete Logarithm Problem (DLP)
Lecture 33 - The Diffie-Hellman Problem and Security of ElGamal Systems
Lecture 34 - An Introduction to Elliptic Curve Cryptography
Lecture 35 - Application of Elliptic Curves to Cryptography
Lecture 36 - Implementation of Elliptic Curve Cryptography
Lecture 37 - Secret Sharing Schemes
Lecture 38 - A Tutorial on Network Protocols
Lecture 39 - System Security
Lecture 40 - Firewalls and Intrusion Detection Systems
Lecture 41 - Side Channel Analysis of Cryptographic Implementations
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NPTEL Video Course - Computer Science and Engineering - High Performance Computer Architecture

Subject Co-ordinator - Prof. Ajit Pal

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction & Course Outline
Lecture 2 - Performance
Lecture 3 - Instruction Set Architecture
Lecture 4 - MIPS ISA and Processor
Lecture 5 - MIPS ISA and Processor (Continued...)
Lecture 6 - Pipelining - Introduction
Lecture 7 - Instruction Pipelining
Lecture 8 - Pipeline Hazards
Lecture 9 - Data Hazards
Lecture 10 - Software Pipelining
Lecture 11 - In Quest of Higher ILP
Lecture 12 - In Quest of Higher ILP (Continued...)
Lecture 13 - Dynamic Instruction Scheduling
Lecture 14 - Dynamic Instruction Scheduling (Continued...)
Lecture 15 - Control Hazards
Lecture 16 - Branch Prediction
Lecture 17 - Branch Prediction (Continued...)
Lecture 18 - Dynamic Instruction Scheduling with Branch Prediction
Lecture 19 - Hardware-based Speculation
Lecture 20 - Tutorial - I
Lecture 21 - Hierarchical Memory Organization
Lecture 22 - Hierarchical Memory Organization (Continued...1)
Lecture 23 - Hierarchical Memory Organization (Continued...2)
Lecture 24 - Hierarchical Memory Organization (Continued...3)
Lecture 25 - Cache Optimization Techniques (Continued...1)
Lecture 26 - Cache Optimization Techniques (Continued...2)
Lecture 27 - Main Memory Organization
Lecture 28 - Main Memory Optimizations
Lecture 29 - Virtual Memory

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Lecture 30 - Virtual Memory (Continued...)
Lecture 31 - Virtual Machines
Lecture 32 - Storage Technology
Lecture 33 - Storage Technology (Continued...)
Lecture 34 - Case Studies
Lecture 35 - Case Studies (Continued...1)
Lecture 36 - Case Studies (Continued...2)
Lecture 37 - Multithreading & Multiprocessing
Lecture 38 - Simultaneous Multithreading
Lecture 39 - Symmetric Multiprocessors
Lecture 40 - Distributed Memory Multiprocessors
Lecture 41 - Cluster, Grid and Cloud Computing
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NPTEL Video Course - Computer Science and Engineering - Low Power VLSI Circuits and Systems

Subject Co-ordinator - Prof. Ajit Pal

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction & Course Outline
Lecture 2 - MOS Transistors - I
Lecture 3 - MOS Transistors - II
Lecture 4 - MOS Transistors - III
Lecture 5 - MOS Transistors - IV
Lecture 6 - MOS Inverters - I
Lecture 7 - MOS Inverters - II
Lecture 8 - MOS Inverters - III
Lecture 9 - MOS Inverters - IV
Lecture 10 - Static CMOS Circuits - I
Lecture 11 - Static CMOS Circuits - II
Lecture 12 - MOS Dynamic Circuits - I
Lecture 13 - MOS Dynamic Circuits - II
Lecture 14 - Pass Transistor Logic Circuits - I
Lecture 15 - Pass Transistor Logic Circuits - II
Lecture 16 - MOS Memories
Lecture 17 - Finite State Machines
Lecture 18 - Switching Power Dissipation
Lecture 19 - Tutorial - I
Lecture 20 - Dynamic Power Dissipation
Lecture 21 - Leakage Power Dissipation
Lecture 22 - Supply Voltage Scaling - I
Lecture 23 - Supply Voltage Scaling - II
Lecture 24 - Supply Voltage Scaling - III
Lecture 25 - Supply Voltage Scaling - IV
Lecture 26 - Tutorial - II
Lecture 27 - Minimizing Switched Capacitance - I
Lecture 28 - Minimizing Switched Capacitance - II
Lecture 29 - Minimizing Switched Capacitance - III

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Lecture 30 - Minimizing Switched Capacitance - IV
Lecture 31 - Minimizing Switched Capacitance - V
Lecture 32 - Minimizing Leakage Power - I
Lecture 33 - Minimizing Leakage Power - II
Lecture 34 - Minimizing Leakage Power - III
Lecture 35 - Variation Tolerant Design
Lecture 36 - Adiabatic Logic Circuits
Lecture 37 - Battery-Driven System Design
Lecture 38 - CAD Tools for Low Power
Lecture 39 - Tutorial - III
Lecture 40 - Course Summary
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NPTEL Video Course - Computer Science and Engineering - Real Time Systems

Subject Co-ordinator - Prof. Rajib Mall

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction
Lecture 2 - Real - Time System Characteristics
Lecture 3 - Few Basic Issues
Lecture 4 - Modelling Timing Constraints
Lecture 5 - Modelling Timing Constraints (Continued.)
Lecture 6 - Basics of Real - Time Task Scheduling
Lecture 7 - Cyclic Scheduler
Lecture 8 - Event - Driven Scheduling
Lecture 9 - Rate Monotonic Scheduler
Lecture 10 - RMA Scheduling
Lecture 11 - Deadline Monotonic Scheduling and Other Issues
Lecture 12 - Few Issues in Use of RMA
Lecture 13 - Resource Sharing Among Real-Time Tasks
Lecture 14 - Highest Locker and Priority Ceiling Protocols
Lecture 15 - An Analysis of Priority Ceiling Protocol
Lecture 16 - Handling Task Dependencies
Lecture 17 - Real-Time Task Scheduling on Multiprocessors and Distributed Systems
Lecture 18 - Real-Time Task Scheduling on Multiprocessors and Distributed Systems (Continued.)
Lecture 19 - Clock Synchronization in Distributed Real-Time Systems
Lecture 20 - Internal Clock Synchronization in Presence of Byzantine Clocks
Lecture 21 - A Few Basic Issues in Real-Time Operating Systems
Lecture 22 - Tutorial - I
Lecture 23 - A Few Basic Issues in Real-Time Operating Systems (Continued.)
Lecture 24 - Unix and Windows as RTOS
Lecture 25 - Real - Time POSIX
Lecture 26 - Real - Time POSIX (Continued.)
Lecture 27 - Open Source and Commercial RTOS
Lecture 28 - Open Source and Commercial RTOS (Continued.)
Lecture 29 - Benchmarking Real - Time Computer & Operating Systems

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Lecture 30 - Benchmarking Real - Time Computer & Operating Systems (Continued.)
Lecture 31 - Real - Time Communications
Lecture 32 - Few Basic Issues in Real - Time Communications
Lecture 33 - Review of Computer Networking
Lecture 34 - Real - Time Communication in a LAN
Lecture 35 - Real - Time Communication in a LAN (Continued.)
Lecture 36 - Performance of Two Real -Time Communication Protocols
Lecture 37 - Real - Time Communication over Packet Switched Networks
Lecture 38 - Real - Time Communication over Packet Switched Networks (Continued.)
Lecture 39 - Real - Time Communication over Packet Switched Networks (Continued.)
Lecture 40 - Real - Time Databases
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NPTEL Video Course - Computer Science and Engineering - Artificial Intelligence (Prof. Anupam Basu)

Subject Co-ordinator - Prof. Sudeshna Sarkar, Prof. Anupam Basu

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to Artificial Intelligence
Lecture 2 - Intelligent Agents
Lecture 3 - State Space Search
Lecture 4 - Uninformed Search
Lecture 5 - Informed Search
Lecture 6 - Informed Search - 2
Lecture 7 - Two Players Games - I
Lecture 8 - Two Players Games - II
Lecture 9 - Constraint Satisfaction Problems - 1
Lecture 10 - Constraint Satisfaction Problems - 2
Lecture 11 - Knowledge Representation and Logic
Lecture 12 - Interface in Propositional Logic
Lecture 13 - First Order Logic
Lecture 14 - Reasoning Using First Order Logic
Lecture 15 - Resolution in FOPL
Lecture 16 - Rule Based System
Lecture 17 - Rule Based Systems II
Lecture 18 - Semantic Net
Lecture 19 - Reasoning in Semantic Net
Lecture 20 - Frames
Lecture 21 - Planning - 1
Lecture 22 - Planning - 2
Lecture 23 - Planning - 3
Lecture 24 - Planning - 4
Lecture 25 - Rule Based Expert System
Lecture 26 - Reasoning with Uncertainty - I
Lecture 27 - Reasoning with Uncertainty - II
Lecture 28 - Reasoning with Uncertainty - III
Lecture 29 - Reasoning with Uncertainty - IV

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Lecture 30 - Fuzzy Reasoning - I
Lecture 31 - Fuzzy Reasoning - II
Lecture 32 - Introduction to Learning - I
Lecture 33 - Introduction to Learning - II
Lecture 34 - Rule Induction and Decision Trees - I
Lecture 35 - Rule Induction and Decision Trees - II
Lecture 36 - Learning Using neural Networks - I
Lecture 37 - Learning Using Neural Networks - II
Lecture 38 - Probabilistic Learning
Lecture 39 - Natural Language Processing - I
Lecture 40 - Natural Language Processing - II
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NPTEL Video Course - Computer Science and Engineering - Artificial Intelligence (Prof. P. Dasgupta)

Subject Co-ordinator - Prof. P. Dasgupta

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to Artificial Intelligence
Lecture 2 - Problem Solving by Search
Lecture 3 - Searching with Costs
Lecture 4 - Informed State Space Search
Lecture 5 - Heuristic Search
Lecture 6 - Problem Reduction Search
Lecture 7 - Searching Game Trees
Lecture 8 - Knowledge Based Systems
Lecture 9 - First Order Logic
Lecture 10 - Inference in First Order Logic
Lecture 11 - Resolution - Refutation Proofs
Lecture 12 - Resolution Refutation Proofs
Lecture 13 - Logic Programming
Lecture 14 - Prolog Programming
Lecture 15 - Prolog
Lecture 16 - Additional Topics
Lecture 17 - Introduction to Planning
Lecture 18 - Partial Order Planning
Lecture 19 - GraphPLAN and SATPlan
Lecture 20 - SATPlan
Lecture 21 - Reasoning under uncertainty
Lecture 22 - Bayesian Networks
Lecture 23 - Reasoning with Bayes Networks
Lecture 24 - Reasoning with Bayes networks (Contd.)
Lecture 25 - Reasoning under uncertainty
Lecture 26 - Learning
Lecture 27 - Learning
Lecture 28 - Back Propagation Learning

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NPTEL Video Course - Computer Science and Engineering - Computer Networks

Subject Co-ordinator - Prof. Sujoy Ghosh

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Emergence of Networks & Reference Models
Lecture 2 - Network Topology
Lecture 3 - Physical Medium - I
Lecture 4 - Physical Medium - II
Lecture 5 - Multiplexing (Sharing a Medium)
Lecture 6 - Telecom Networks
Lecture 7 - Switches - I
Lecture 8 - Pocket Switches
Lecture 9 - SONET/SDH
Lecture 10 - Fiber Optic Components
Lecture 11 - Routing and Wavelength Assignment
Lecture 12 - Protection and Restoration
Lecture 13 - Multiple Access
Lecture 14 - Token Based Mac
Lecture 15 - Data Link Protocols
Lecture 16 - Error Control
Lecture 17 - Stop & Wait Protocol
Lecture 18 - Satellite Communication
Lecture 19 - Ethernet - CSMA/CD
Lecture 20 - Modern Ethernet
Lecture 21 - Local Internetworking
Lecture 22 - Cellular Networks
Lecture 23 - Wireless Network
Lecture 24 - ATM
Lecture 25 - ATM Signaling, Routing and LAN Emulation
Lecture 26 - Introduction to Routing
Lecture 27 - RIP - Distance Vector Routing
Lecture 28 - IP version 4
Lecture 29 - IP Version 6 & Mobile IP

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Lecture 30 - UDP & Client Server
Lecture 31 - TCP
Lecture 32 - IP Multicasting
Lecture 33 - DHCP and ICMP
Lecture 34 - DNS & Directory
Lecture 35 - Congestion Control
Lecture 36 - QOS & Multimedia
Lecture 37 - Network Management
Lecture 38 - Security
Lecture 39 - FTP - SMTP
Lecture 40 - HTTP
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NPTEL Video Course - Computer Science and Engineering - Data Communication

Subject Co-ordinator - Prof. Ajit Pal

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction and Course Outline - Data Communication
Lecture 2 - Layered Architecture
Lecture 3 - Data and Signal
Lecture 4 - Transmission Impairments and Channel Capacity
Lecture 5 - Guided Transmission Media
Lecture 6 - Unguided Media
Lecture 7 - Transmission of Digital Signal - I
Lecture 8 - Transmission of Digital Signal - II
Lecture 9 - Transmission of Analog Signal - I
Lecture 10 - Transmission of Analog Signal - II
Lecture 11 - Multiplexing
Lecture 12 - Multiplexing
Lecture 13 - Multiplexing Applications - I
Lecture 14 - Multiplexing Applications - II
Lecture 15 - Interfacing to the Media
Lecture 16 - Error Detection and Correction
Lecture 17 - Flow and Error Control
Lecture 18 - Data Link Control
Lecture 19 - Switching Techniques Circuit Switching
Lecture 20 - Switching Techniques Packet Switching
Lecture 21 - Routing - I
Lecture 22 - Routing - II
Lecture 23 - Congestion Control
Lecture 24 - X.25 and Frame Relay
Lecture 25 - ATM
Lecture 26 - Medium Access Control - I
Lecture 27 - Medium Access Control - II
Lecture 28 - Medium Access Control - III
Lecture 29 - IEEE 802 LANs

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Lecture 30 - High Speed LANs
Lecture 31 - Wireless LANs
Lecture 32 - Cellular Telephone Systems
Lecture 33 - Satellite Communications
Lecture 34 - Internet and Internetworking
Lecture 35 - TCP/IP - I
Lecture 36 - TCP/IP - II
Lecture 37 - Multimedia Networks
Lecture 38 - Audio and Video Compression
Lecture 39 - Multimedia Services
Lecture 40 - Secured Communication - I
Lecture 41 - Secured Communication - II
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NPTEL Video Course - Computer Science and Engineering - Electronic Design Automation

Subject Co-ordinator - Prof. Indranil Sengupta

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable


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Lecture 1 - Introduction
Lecture 2 - Verilog
Lecture 3 - Verilog
Lecture 4 - Verilog
Lecture 5 - Verilog
Lecture 6 - Verilog
Lecture 7 - Verilog
Lecture 8 - Synthesis
Lecture 9 - Synthesis
Lecture 10 - Synthesis
Lecture 11 - Synthesis
Lecture 12 - Synthesis
Lecture 13 - Synthesis
Lecture 14 - Synthesis
Lecture 15 - Backend Design
Lecture 16 - Backend Design
Lecture 17 - Backend Design
Lecture 18 - Backend Design
Lecture 19 - Backend Design
Lecture 20 - Backend Design
Lecture 21 - Backend Design
Lecture 22 - Backend Design
Lecture 23 - Backend Design
Lecture 24 - Backend Design
Lecture 25 - Backend Design
Lecture 26 - Backend Design
Lecture 27 - Backend Design
Lecture 28 - Backend Design
Lecture 29 - Backend Design
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Lecture 30 - Testing Part - I
Lecture 31 - Testing Part - II
Lecture 32 - Testing Part - III
Lecture 33 - Testing Part - IV
Lecture 34 - Testing Part - V
Lecture 35 - Testing Part - VI
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NPTEL Video Course - Computer Science and Engineering - Internet Technology

Subject Co-ordinator - Prof. Indranil Sengupta

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction To Internet
Lecture 2 - Review Of Network Technologies
Lecture 3 - TCP/IP - Part-I
Lecture 4 - TCP/IP - Part-II
Lecture 5 - TCP/IP - Part-III
Lecture 6 - IP Subnetting and Addressing
Lecture 7 - Internet Routing Protocol - Part-I
Lecture 8 - Internet Routing Protocol - Part-II
Lecture 9 - Client Server Concepts DNS, Telnet, FTP
Lecture 10 - Electronic Mail
Lecture 11 - World Wide Web - Part-I
Lecture 12 - World Wide Web - Part-II
Lecture 13 - HTML
Lecture 14 - HTML
Lecture 15 - HTML
Lecture 16 - Extensible Markup Language (XML)
Lecture 17 - HTML Forms
Lecture 18 - Image Maps
Lecture 19 - CGI Scripts
Lecture 20 - Other Technologies
Lecture 21 - PERL - Part-I
Lecture 22 - PERL - Part II
Lecture 23 - PERL - Part III
Lecture 24 - PERL - Part IV
Lecture 25 - Javascript
Lecture 26 - Javascript Examples (Continued)
Lecture 27 - Using Cookies
Lecture 28 - Java Applets
Lecture 29 - Java Applets

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Lecture 30 - Client-Server Programming In Java
Lecture 31 - Intranet, Extranet, Firewall
Lecture 32 - Basic Cryptographic Concepts Part - I
Lecture 33 - Basic Cryptographic Concepts Part - II
Lecture 34 - Basic Cryptographic Concepts Part - III
Lecture 35 - Electronic Commerce
Lecture 36 - Streaming Multimedia Applications
Lecture 37 - Internet Telephony
Lecture 38 - Search Engine And Web Crawlers
Lecture 39 - Search Engine And Web Crawlers
Lecture 40 - Course Summary And Conclusion
```

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NPTEL Video Course - Computer Science and Engineering - Programming and Data Structure

Subject Co-ordinator - Dr. P.P. Chakraborty

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable


```
Lecture 1 - Introduction
Lecture 2 - C Programming - I
Lecture 3 - C Programming - II
Lecture 4 - C Programming - III
Lecture 5 - Data Structuring
Lecture 6 - Data Structuring
Lecture 7 - Data Structuring
Lecture 8 - Problem Decomposition By Recursion - I
Lecture 9 - Problem Decomposition By Recursion - II
Lecture 10 - Problem Decomposition By Recursion - III
Lecture 11 - Merge sort And Quick sort
Lecture 12 - Characters And Strings
Lecture 13 - Arrays
Lecture 14 - Structures - I
Lecture 15 - Structures - II
Lecture 16 - Dynamic Allocation Part - I
Lecture 17 - Linked Lists - I
Lecture 18 - Complexity (Efficiency) of Algorithms
Lecture 19 - Asymptotic Growth Functions
Lecture 20 - Asymptotic Analysis of Algorithms
Lecture 21 - Data Structuring
Lecture 22 - Search Trees
Lecture 23 - Search Trees - II
Lecture 24 - Search Trees - III
Lecture 25 - 2-3 Trees
Lecture 26 - Algorithm Design - I
Lecture 27 - Algorithm Design - II
Lecture 28 - Algorithm Design - III
Lecture 29 - Graphs - I
```

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NPTEL Video Course - Computer Science and Engineering - NOC:Software Testing

Subject Co-ordinator - Prof. Rajib Mall

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction
Lecture 2 - Levels of Testing
Lecture 3 - Basic Concepts in Testing
Lecture 4 - Basic Concepts in Testing (Continued...)
Lecture 5 - Unit Testing
Lecture 6 - Equivalence and BV Testing
Lecture 7 - Special Value Testing
Lecture 8 - Combinatorial Testing
Lecture 9 - Pairwise Testing
Lecture 10 - White Box Testing
Lecture 11 - MC/DC Testing
Lecture 12 - MC/DC Testing (Continued...)
Lecture 13 - Path Testing
Lecture 14 - Dataflow and Mutation Testing
Lecture 15 - Mutation Testing
Lecture 16 - Integration Testing
Lecture 17 - System Testing
Lecture 18 - Regression Testing
Lecture 19 - Testing Object-Oriented Program - Part 1
Lecture 20 - Testing Object-Oriented Program - Part 2

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NPTEL Video Course - Computer Science and Engineering - NOC:Programming in C++

Subject Co-ordinator - Prof. Partha Pratim Das

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable │ MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Module 1
Lecture 2 - Module 1
Lecture 3 - Module 1
Lecture 4 - Module 2
Lecture 5 - Module 3
Lecture 6 - Module 4
Lecture 7 - Module 5
Lecture 8 - Module 6
Lecture 9 - Module 6
Lecture 10 - Module 7
Lecture 11 - Module 7
Lecture 12 - Module 8
Lecture 13 - Module 8
Lecture 14 - Module 8
Lecture 15 - Module 9
Lecture 16 - Module 9
Lecture 17 - Module 10
Lecture 18 - Module 10
Lecture 19 - Module 11
Lecture 20 - Module 11
Lecture 21 - Module 12
Lecture 22 - Module 12
Lecture 23 - Module 13
Lecture 24 - Module 13
Lecture 25 - Module 13
Lecture 26 - Module 14
Lecture 27 - Module 14
Lecture 28 - Module 14
Lecture 29 - Module 15

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Lecture 30 - Module 15
Lecture 31 - Module 16
Lecture 32 - Module 17
Lecture 33 - Module 18
Lecture 34 - Module 19
Lecture 35 - Module 20
Lecture 36 - Module 21
Lecture 37 - Module 22
Lecture 38 - Module 23
Lecture 39 - Module 24
Lecture 40 - Module 25
Lecture 41 - Module 26
Lecture 42 - Module 27
Lecture 43 - Module 28
Lecture 44 - Module 29
Lecture 45 - Module 30
Lecture 46 - Module 31
Lecture 47 - Module 32
Lecture 48 - Module 33
Lecture 49 - Module 34
Lecture 50 - Module 35
Lecture 51 - Module 35
Lecture 52 - Module 36
Lecture 53 - Module 37
Lecture 54 - Module 38
Lecture 55 - Module 39
Lecture 56 - Module 40
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NPTEL Video Course - Computer Science and Engineering - NOC:Introduction to Machine Learning

Subject Co-ordinator - Prof. S. Sarkar

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable │ MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction
Lecture 2 - Different Types of Learning
Lecture 3 - Hypothesis Space and Inductive Bias
Lecture 4 - Evaluation and Cross-Validation
Lecture 5 - Tutorial - I
Lecture 6 - Linear Regression
Lecture 7 - Introduction to Decision Trees
Lecture 8 - Learning Decision Tree
Lecture 9 - Overfitting
Lecture 10 - Python Exercise on Decision Tree and Linear Regression
Lecture 11 - Tutorial - II
Lecture 12 - k-Nearest Neighbour
Lecture 13 - Feature Selection
Lecture 14 - Feature Extraction
Lecture 15 - Collaborative Filtering
Lecture 16 - Python Exercise on kNN and PCA
Lecture 17 - Tutorial - III
Lecture 18 - Bayesian Learning
Lecture 19 - Naive Bayes
Lecture 20 - Bayesian Network
Lecture 21 - Python Exercise on Naive Bayes
Lecture 22 - Tutorial - IV
Lecture 23 - Logistic Regression
Lecture 24 - Introduction Support Vector Machine
Lecture 25 - SVM
Lecture 26 - SVM
Lecture 27 - Nonlinear SVM and Kennel Function
Lecture 28 - SVM
Lecture 29 - Python Exercise on SVM

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Lecture 30 - Introduction
Lecture 31 - Multilayer Neural Network
Lecture 32 - Neural Network and Backpropagation Algorithm
Lecture 33 - Deep Neural Network
Lecture 34 - Python Exercise on Neural Network
Lecture 35 - Tutorial - VI
Lecture 36 - Introduction to Computational Learning Theory
Lecture 37 - Sample Complexity
Lecture 38 - VC Dimension
Lecture 39 - Introduction to Ensembles
Lecture 40 - Bagging and Boosting
Lecture 41 - Introduction to Clustering
Lecture 42 - Kmeans Clustering
Lecture 43 - Agglomerative Hierarchical Clustering
Lecture 44 - Python Exercise on kmeans clustering
```

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NPTEL Video Course - Computer Science and Engineering - NOC:Object-Oriented Analysis and Design

Subject Co-ordinator - Prof. Partha Pratim Das

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Challanges in Software Engineering
Lecture 2 - Complexity of Software
Lecture 3 - Complexity of Software (Continued...)
Lecture 4 - Structure and Attributes of a Complex System
Lecture 5 - Structure and Attributes of a Complex System (Continued...)
Lecture 6 - Object-Oriented Analysis and Design
Lecture 7 - Bringing Order to Chaos
Lecture 8 - Bringing Order to Chaos (Continued...)
Lecture 9 - Evolution of Object Models - Programming Languages and Paradigms
Lecture 10 - Foundations of the Object Model - OOA, OOD and OOP
Lecture 11 - Foundations of the Object Model - OOA, OOD and OOP (Continued...)
Lecture 12 - Elements of Object Model (Major)
Lecture 13 - Elements of Object Model (Major)
Lecture 14 - Elements of the Object Model (Major)
Lecture 15 - Elements of the Object Model (Major)
Lecture 16 - Elements of the Object Model (Minor)
Lecture 17 - Elements of the Object Model (Minor)
Lecture 18 - Nature of an object
Lecture 19 - Nature of an object
Lecture 20 - Relationships among objects
Lecture 21 - Relationships among objects (Continued...)
Lecture 22 - Nature of a class
Lecture 23 - Nature of a class
Lecture 24 - Relationships among classes
Lecture 25 - Relationships among classes (Continued...)
Lecture 26 - How to Build Quality Classes and Objects
Lecture 27 - Tutorial
Lecture 28 - How to Identify Classes and Objects ?
Lecture 29 - Identification of Classes, Objects and Relationship in LMS

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Lecture 30 - Identification of Classes, Objects and Relationship in LMS (Continued...)
Lecture 31 - Identification of Classes, Objects and Relationship in LMS (Continued...)
Lecture 32 - Identification of Classes, Objects and Relationship in LMS (Continued...)
Lecture 33 - Overview of UML
Lecture 34 - SDLC Phases and UML Diagrams
Lecture 35 - Use-Case Diagrams - Part I
Lecture 36 - Use-Case Diagrams - Part II
Lecture 37 - Use-Case Diagrams - Part III
Lecture 38 - Class Diagrams - Part 1 (Class, Property and Operation)
Lecture 39 - Class Diagrams - Part 2 (Association, Weak and Strong Aggregation)
Lecture 40 - Class Diagrams - Part 3 (Generalization, Dependency and Constraints)
Lecture 41 - Sequence Diagrams - Part 1
Lecture 42 - Sequence Diagrams - Part 2
Lecture 43 - Communication Diagram
Lecture 44 - Activity Diagrams - Part II
Lecture 45 - Activity Diagrams - Part II
Lecture 46 - Activity Diagrams - Part III
Lecture 47 - Interaction Overview Diagram
Lecture 48 - State Machine Diagrams - Part I
Lecture 49 - State Machine Diagrams - Part II
Lecture 50 - State Machine Diagrams - Part III
Lecture 51 - Various UML Diagrams
Lecture 52 - Closing Comments
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NPTEL Video Course - Computer Science and Engineering - NOC:Complex Network : Theory and Application

Subject Co-ordinator - Prof. Animesh Mukherjee

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction
Lecture 2 - Network Analysis - I
Lecture 3 - Network Analysis - II
Lecture 4 - Network Analysis - III
Lecture 5 - Network Analysis - IV
Lecture 6 - Network Analysis - V
Lecture 7 - Network Analysis - VI
Lecture 8 - Social Network Principles - I
Lecture 9 - Social Network Principles - II
Lecture 10 - Social Network Principles - III
Lecture 11 - Social Network Principles - IV
Lecture 12 - Community Analysis - I
Lecture 13 - Community Analysis - II
Lecture 14 - Community Analysis - III
Lecture 15 - Community Analysis - IV
Lecture 16 - Community Analysis - V
Lecture 17 - Community Analysis - VI
Lecture 18 - Citation Analysis - I
Lecture 19 - Citation Analysis - II
Lecture 20 - Citation Analysis - III
Lecture 21 - Citation Analysis - IV

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NPTEL Video Course - Computer Science and Engineering - Fundamental Algorithms:Design and Analysis

Subject Co-ordinator - Prof.Sourav Mukhopadhyay

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Insertion Sort and Asymptotic Analysis
Lecture 2 - Solving Recurrences
Lecture 3 - Divide and Conquer Paradigm
Lecture 4 - Quick Sort
Lecture 5 - Heap Sort
Lecture 6 - Decision Tree
Lecture 7 - Linear Time Sorting
Lecture 8 - Order Statistics
Lecture 9 - Hashing
Lecture 10 - Universal Hashing, BST Sort
Lecture 11 - Red-Black Tree
Lecture 12 - Augmenting Data Structure
Lecture 13 - Computational Geometry
Lecture 14 - Van Emde Boas Data Structure
Lecture 15 - Dynamic Programming
Lecture 16 - Graph Algorithm
Lecture 17 - BFS and DFS
Lecture 18 - Dijkstra
Lecture 19 - Bellman Ford
Lecture 20 - Floyd Marshall

NPTEL Video Course - Computer Science and Engineering - NOC:Natural Language Processing

Subject Co-ordinator - Prof. Pawan Goyal

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to the Course
Lecture 2 - What Do We Do in NLP
Lecture 3 - Why is NLP hard
Lecture 4 - Empirical Laws
Lecture 5 - Text Processing
Lecture 6 - Spelling Correction
Lecture 7 - Weighted Edit Distance, Other Variations
Lecture 8 - Noisy Channel Model for Spelling Correction
Lecture 9 - N-Gram Language Models
Lecture 10 - Evaluation of Language Models, Basic Smoothing
Lecture 11 - Tutorial I
Lecture 12 - Language Modeling
Lecture 13 - Computational Morphology
Lecture 14 - Finite - State Methods for Morphology
Lecture 15 - Introduction to POS Tagging
Lecture 16 - Hidden Markov Models for POS Tagging
Lecture 17 - Viterbi Decoding for HMM, Parameter Learning
Lecture 18 - Baum Welch Algorithm
Lecture 19 - Maximum Entropy Models - I
Lecture 20 - Maximum Entropy Models - II
Lecture 21 - Conditional Random Fields
Lecture 22 - Syntax - Introduction
Lecture 23 - Syntax - Parsing I
Lecture 24 - Syntax - CKY, PCFGs
Lecture 25 - PCFGs - Inside-Outside Probabilities
Lecture 26 - Inside-Outside Probabilities
Lecture 27 - Dependency Grammars and Parsing - Introduction
Lecture 28 - Transition Based Parsing
Lecture 29 - Transition Based Parsing

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Lecture 30 - MST-Based Dependency Parsing
Lecture 31 - MST-Based Dependency Parsing
Lecture 32 - Distributional Semantics - Introduction
Lecture 33 - Distributional Models of Semantics
Lecture 34 - Distributional Semantics
Lecture 35 - Word Embeddings - Part I
Lecture 36 - Word Embeddings - Part II
Lecture 37 - Lexical Semantics
Lecture 38 - Lexical Semantics - Wordnet
Lecture 39 - Word Sense Disambiguation - I
Lecture 40 - Word Sense Disambiguation - II
Lecture 41 - Novel Word Sense detection
Lecture 42 - Topic Models
Lecture 43 - Latent Dirichlet Allocation
Lecture 44 - Gibbs Sampling for LDA, Applications
Lecture 45 - LDA Variants and Applications - I
Lecture 46 - LDA Variants and Applications - II
Lecture 47 - Entity Linking - I
Lecture 48 - Entity Linking - II
Lecture 49 - Information Extraction - Introduction
Lecture 50 - Relation Extraction
Lecture 51 - Distant Supervision
Lecture 52 - Text Summarization - LEXRANK
Lecture 53 - Optimization based Approaches for Summarization
Lecture 54 - Summarization Evaluation
Lecture 55 - Text Classification - I
Lecture 56 - Text Classification - II
Lecture 57 - Tutorial II
Lecture 58 - Tutorial III
Lecture 59 - Tutorial IV
Lecture 60 - Tutorial V
Lecture 61 - Sentiment Analysis - Introduction
Lecture 62 - Sentiment Analysis - Affective Lexicons
Lecture 63 - Learning Affective Lexicons
Lecture 64 - Computing with Affective Lexicons
Lecture 65 - Aspect - Based Sentiment Analysis
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NPTEL Video Course - Computer Science and Engineering - NOC:Embedded Systems Design

Subject Co-ordinator - Prof. Anupam Basu

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction
Lecture 2 - Processors
Lecture 3 - General Purpose and ASIPs Processor
Lecture 4 - Designing a Single Purpose Processor
Lecture 5 - Optimization Issues
Lecture 6 - Introduction to FPFA
Lecture 7 - FPGA (Continued...)
Lecture 8 - Behaviour Synthesis on FPGA using VHDL
Lecture 9 - Tutorial - I
Lecture 10 - Tutorial - II
Lecture 11 - Tutorial - III
Lecture 12 - Tutorial - IV
Lecture 13 - Sensors and Signals
Lecture 14 - Discretization of Signals and A/D Converter
Lecture 15 - Quantization Noise, SNR and D/A Converter
Lecture 16 - Arduino Uno
Lecture 17 - Arduino Uno (Continued...), Serial Communication and Timer
Lecture 18 - Controller Design using Arduino
Lecture 19 - Tutorial - V
Lecture 20 - Power Aware Embedded System - I
Lecture 21 - Power Aware Embedded System - II
Lecture 22 - SD and DD Algorithm
Lecture 23 - Parallel Operations and VLIW
Lecture 24 - Code Efficiency
Lecture 25 - DSP Application and Address Generation Unit
Lecture 26 - Real Time O.S - I
Lecture 27 - Real Time O.S - II
Lecture 28 - RMS Algorithm
Lecture 29 - EDF Algorithm and Resource Constraint Issue

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Lecture 30 - Priority Inversion and Priority Inheritance Protocol
Lecture 31 - Modeling and Specification - I
Lecture 32 - Modeling and Specification - II
Lecture 33 - FSM and Statechart
Lecture 34 - Statechart and Statemate Semantics
Lecture 35 - Statecharts (Continued...)
Lecture 36 - Program State Machines
Lecture 37 - SDL
Lecture 38 - Data Flow Model - I
Lecture 39 - Data Flow Model - II
Lecture 40 - Hardware Synthesis - I
Lecture 41 - Hardware Synthesis - II
Lecture 42 - Scheduling
Lecture 43 - Digital Camera Design
Lecture 44 - Digital Camera - Iterative Design
Lecture 45 - HW-SW Partitioning
Lecture 46 - Optimization - I
Lecture 47 - Optimization - II
Lecture 48 - Simulation
Lecture 49 - Formal Verification
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NPTEL Video Course - Computer Science and Engineering - NOC:Wireless Ad Hoc and Sensor Networks

Subject Co-ordinator - Prof. Sudip Misra

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction
Lecture 2 - Introduction
Lecture 3 - Self-organizing Behaviour of Wireless Ad Hoc Networks
Lecture 4 - Cooperation in Mobile Ad Hoc Networks - Part-I
Lecture 5 - Cooperation in Mobile Ad Hoc Networks - Part-II
Lecture 6 - MAC Protocols in MANETs - Part-I
Lecture 7 - MAC Protocols in MANETs - Part-II
Lecture 8 - Routing in MANETs - Part-I
Lecture 9 - Routing in MANETs - Part-II
Lecture 10 - Routing in MANETs - Part-III
Lecture 11 - Multicasting in MANETs
Lecture 12 - Mobility Models for MANETs
Lecture 13 - Transport Protocols for MANETs - Part-I
Lecture 14 - Transport Protocols for MANETs - Part-II
Lecture 15 - Opportunistic Mobile Networks - Part-I
Lecture 16 - Opportunistic Mobile Networks - Part-II
Lecture 17 - Opportunistic Mobile Networks - Part-III
Lecture 18 - UAV Networks - Part-I
Lecture 19 - UAV Networks - Part-II
Lecture 20 - UAV Networks - Part-III
Lecture 21 - Introduction
Lecture 22 - Introduction
Lecture 23 - WSN Coverage and Placement - Part-I
Lecture 24 - Topology Mangement in Wireless Sensor Network
Lecture 25 - Mobile Wireless Sensor Networks
Lecture 26 - Mobile Wireless Sensor Networks
Lecture 27 - Medium Access Control in Wireless Networks - Part-I
Lecture 28 - Medium Access Control in Wireless Networks - Part-II
Lecture 29 - Routing in Wireless Sensor Networks - Part-I

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Lecture 30 - Routing in Wireless Sensor Networks - Part-II
Lecture 31 - Congestion and Flow Control - Part-I
Lecture 32 - Congestion and Flow Control - Part-II
Lecture 33 - Underwater Sensor Networks - Part-I
Lecture 34 - Underwater Sensor Networks - Part-II
Lecture 35 - Underwater Sensor Networks - Part-III
Lecture 36 - Underwater Sensor Networks - Part-IV
Lecture 37 - Security of Wireless Sensor Networks - Part-I
Lecture 38 - Security of Wireless Sensor Networks - Part-II
Lecture 39 - Hardware Design of Sensor Node
Lecture 40 - Real Life Deployment of WSN
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NPTEL Video Course - Computer Science and Engineering - NOC:VLSI Physical Design

Subject Co-ordinator - Prof. Indranil Sengupta

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction
Lecture 2 - Design Representation
Lecture 3 - VLSI Design Styles - Part 1
Lecture 4 - VLSI Design Styles - Part 2
Lecture 5 - VLSI Physical Design Automation - Part 1
Lecture 6 - VLSI Physical Design Automation - Part 2
Lecture 7 - Partitioning
Lecture 8 - Floor planning
Lecture 9 - Floor planning Algorithms
Lecture 10 - Pin Assignment
Lecture 11 - Placement - Part 1
Lecture 12 - Placement - Part 2
Lecture 13 - Placement - Part 3
Lecture 14 - Placement - Part 4
Lecture 15 - Grid Routing - Part 1
Lecture 16 - Grid Routing - Part 2
Lecture 17 - Grid Routing - Part 3
Lecture 18 - Global Routing - Part 1
Lecture 19 - Global Routing - Part 2
Lecture 20 - Detailed Routing - Part 1
Lecture 21 - Detailed Routing - Part 2
Lecture 22 - Detailed Routing - Part 3
Lecture 23 - Detailed Routing - Part 4
Lecture 24 - Clock Design - Part 1
Lecture 25 - Clock Design - Part 2
Lecture 26 - Clock Design - Part 3
Lecture 27 - Clock Network Synthesis - Part 1
Lecture 28 - Clock Network Synthesis - Part 2
Lecture 29 - Clock Network Synthesis - Part 3

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Lecture 30 - Clock Network Synthesis - Part 4
Lecture 31 - Power and Ground Routing
Lecture 32 - Time Closure - Part 1
Lecture 33 - Time Closure - Part 2
Lecture 34 - Time Closure - Part 3
Lecture 35 - Time Closure - Part 4
Lecture 36 - Time Closure - Part 5
Lecture 37 - Timing Driven Placement
Lecture 38 - Timing Driven Routing
Lecture 39 - Physical Synthesis - Part 1
Lecture 40 - Physical Synthesis - Part 2
Lecture 41 - Performance-Driven Design Flow
Lecture 42 - Miscellaneous Approaches to Timing Optimization
Lecture 43 - Interconnect Modeling - Part 1
Lecture 44 - Interconnect Modeling - Part 2
Lecture 45 - Design Rule Check
Lecture 46 - Layout Compaction - Part 1
Lecture 47 - Layout Compaction - Part 2
Lecture 48
Lecture 49
Lecture 50
Lecture 51
Lecture 52
Lecture 53 - Test Pattern Generation
Lecture 54 - Design for Testability
Lecture 55 - Boundary Scan Standard
Lecture 56 - Built-in Self-Test - Part 1
Lecture 57 - Built-in Self-Test - Part 2
Lecture 58 - Low Power VLSI Design
Lecture 59 - Techniques to Reduce Power
Lecture 60 - Gate Level Design for Low Power - Part 1
Lecture 61 - Gate Level Design for Low Power - Part 2
Lecture 62 - Other Low Power Design Techniques
Lecture 63 - Algorithmic Level Techniques for Low Power Design
Lecture 64 - Summarization of the Course
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NPTEL Video Course - Computer Science and Engineering - NOC:Cryptography And Network Security

Subject Co-ordinator - Prof. Sourav Mukhopadhyay

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to Cryptography
Lecture 2 - Classical Cryptosystem
Lecture 3 - Cryptanalysis on Substitution Cipher (Frequency Analysis)
Lecture 4 - Play Fair Cipher
Lecture 5 - Block Cipher
Lecture 6 - Data Encryption Standard (DES)
Lecture 7 - DES (Continued...)
Lecture 8 - Triple DES and Modes of Operation
Lecture 9 - Stream Cipher
Lecture 10 - Pseudorandom Sequence
Lecture 11 - LFSR Based StreamCipher
Lecture 12 - Mathematical Background
Lecture 13 - Abstract Algebra (Continued...)
Lecture 14 - Number Theory
Lecture 15 - Number Theory (Continued...)
Lecture 16 - Modular Inverse
Lecture 17 - Extended Euclidean Algorithm
Lecture 18 - Fermat's Little Theorem, Euler Phi-Function
Lecture 19 - Euler's theorem, Quadratic Residue
Lecture 20 - Polynomial Arithmetic
Lecture 21 - Advanced Encryption Standard (AES)
Lecture 22 - Advanced Encryption Standard (AES) (Continued...)
Lecture 23 - Introduction to Public Key Cryptosystem, Diffie-Hellman Key Exchange
Lecture 24 - Knapsack Cryptosystem
Lecture 25 - RSA Cryptosystem
Lecture 26 - More on RSA
Lecture 27 - Primarily Testing
Lecture 28 - ElGamal Cryptosystem
Lecture 29 - Elliptic Curve over the Reals

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Lecture 30 - Elliptic curve Modulo a Prime
Lecture 31 - Generalised ElGamal Public Key Cryptosystem
Lecture 32 - Chinese Remainder Theorem
Lecture 33 - Rabin Cryptosystem
Lecture 34 - Legendre and Jacobi Symbol
Lecture 35 - Jacobi Symbol (Continued...)
Lecture 36 - Message Authentication
Lecture 37 - Digital Signature
Lecture 38 - Key Management
Lecture 39 - Key Exchange
Lecture 40 - Hash Function
Lecture 41 - Universal Hashing
Lecture 42 - Cryptographic Hash Function
Lecture 43 - Secure Hash Algorithm (SHA)
Lecture 44 - Digital Signature Standard (DSS)
Lecture 45 - More on Key Exchange Protocol
Lecture 46 - Cryptoanalisis
Lecture 47 - Memory Trade off Attack
Lecture 48 - Differential Cryptoanalysis
Lecture 49 - More on Differential Cryptoanalysis
Lecture 50 - Linear Cryptoanalysis
Lecture 51 - Cryptoanalysis and Stream Cipher
Lecture 52 - Modern Stream Cipher
Lecture 53 - Shamir Secret Sharing
Lecture 54 - Identity Based Eneryption (IBE)
Lecture 55 - Attribute Based Encryption
Lecture 56 - Functional Encryption (Introduction)
Lecture 57 - Discrete Logarithm Problem (DLP)
Lecture 58 - Implementation Attacks
Lecture 59 - The Secure Sockets layer (SSL)
Lecture 60 - Pretty Good Privacy (PGP)
```

NPTEL Video Course - Computer Science and Engineering - NOC:Computer Architecture and Organization

Subject Co-ordinator - Prof. Indranil Sengupta, Prof. Kamalika Datta

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Evolution of Computer Systems
Lecture 2 - Basic Operation of a Computer
Lecture 3 - Memory Addressing and Languages
Lecture 4 - Software and Architecture Types
Lecture 5 - Instruction Set Architecture
Lecture 6 - Number Representation
Lecture 7 - Instruction Format and Addressing Modes
Lecture 8 - CISC and RISC Architecture
Lecture 9 - MIPS32 Instruction Set
Lecture 10 - MIPS Programming Examples
Lecture 11 - Spim â   A Mips32 Simulator
Lecture 12 - Measuring Cpu Performance
Lecture 13 - Choice Of Benchmarks
Lecture 14 - Summarizing Performance Results
Lecture 15 - Amadahlâ s Law - Part 1
Lecture 16 - Amadahlâ s Law - Part 2
Lecture 17 - Design Of Control Unit - Part 1
Lecture 18 - Design Of Control Unit - Part 2
Lecture 19 - Design Of Control Unit - Part 3
Lecture 20 - Design Of Control Unit - Part 4
Lecture 21 - Mips Implementation - Part 1
Lecture 22 - Mips Implementation - Part 2
Lecture 23 - Processor Memory Interaction
Lecture 24 - Static And Dynamic Ram
Lecture 25 - Asynchronous Dram
Lecture 26 - Synchronous Dram
Lecture 27 - Memory Interfacing And Addressing
Lecture 28 - Memory Hierarchy Design - Part 1
Lecture 29 - Memory Hierarchy Design - Part 2

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```
Lecture 30 - Cache Memory - Part 1
Lecture 31 - Cache Memory - Part 2
Lecture 32 - Improving Cache Performance
Lecture 33 - Design Of Adders - Part 1
Lecture 34 - Design Of Adders - Part 2
Lecture 35 - Design Of Multipliers - Part 1
Lecture 36 - Design Of Multipliers - Part 2
Lecture 37 - Design Of Dividers
Lecture 38 - Floating-Point Numbers
Lecture 39 - Floating-Point Arithmetic
Lecture 40 - Basic Pipelining Concepts
Lecture 41 - Pipeline Scheduling
Lecture 42 - Arithmetic Pipeline
Lecture 43 - Secondary Storage Devices
Lecture 44 - Input-Output Organization
Lecture 45 - Data Transfer Techniques
Lecture 46 - Interrupt Handling - Part 1
Lecture 47 - Interrupt Handling - Part 2
Lecture 48 - Direct Memory Access
Lecture 49 - Some Example Device Interfacing
Lecture 50 - Exercises On I/O Transfer
Lecture 51 - Bus Standards
Lecture 52 - Bus Standards
Lecture 53 - Pipelining The Mips32 Data Path
Lecture 54 - Mips Pipeline (Continued...
Lecture 55 - Pipeline Hazards - Part 1
Lecture 56 - Pipeline Hazards - Part 2
Lecture 57 - Pipeline Hazards - Part 3
Lecture 58 - Pipeline Hazards - Part 4
Lecture 59 - Multicycle Operations In Mips32
Lecture 60 - Exploiting Instruction Level Parallelism
Lecture 61 - Vector Processors
Lecture 62 - Multi-Core Processors
Lecture 63 - Some Case Studies
Lecture 64 - Summarization Of The Course
```

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NPTEL Video Course - Computer Science and Engineering - NOC:Introduction to Algorithms and Analysis

Subject Co-ordinator - Prof. Sourav Mukhopadhyay

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Insertion sort
Lecture 2 - Analysis of Insertion Sort
Lecture 3 - Asymptotic Analysis
Lecture 4 - Recurrence of Merge Sort
Lecture 5 - Substitution Method
Lecture 6 - The Master Method
Lecture 7 - Divide-and-Conquer
Lecture 8 - Divide-and-Conquer (Continued...)
Lecture 9 - Straseen's Algorithms
Lecture 10 - QuickSort
Lecture 11 - Analysis of Quicksort
Lecture 12 - Randomized Quicksort
Lecture 13 - Heap
Lecture 14 - Heap Sort
Lecture 15 - Decision Tree
Lecture 16 - Linear time Sorting
Lecture 17 - Radix Sort and Bucket Sort
Lecture 18 - Order Statistics
Lecture 19 - Randomised Order Statistics
Lecture 20 - Worst case linear time order statistics
Lecture 21 - Hash Function
Lecture 22 - Open Addressing
Lecture 23 - Universal Hashing
Lecture 24 - Perfect Hashing
Lecture 25 - Binary Search Tree (BST) Sort
Lecture 26 - Randomly build BST
Lecture 27 - Red Black Tree
Lecture 28 - Red Black Tree (Continued...)
Lecture 29 - Augmentation of data structure

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```
Lecture 30 - Interval trees
Lecture 31 - Fixed universe successor
Lecture 32 - Van Emde Boas data structure
Lecture 33 - Amortized analysis
Lecture 34 - Computational Geometry
Lecture 35 - Computational Geometry (Continued...)
Lecture 36 - Dynamic Programming
Lecture 37 - Longest common subsequence
Lecture 38 - Graphs
Lecture 39 - Prim's Algorithms
Lecture 40 - Graph Search
Lecture 41
Lecture 42
Lecture 43
Lecture 44
Lecture 45
Lecture 46
Lecture 47
Lecture 48
Lecture 49
Lecture 50
Lecture 51
Lecture 52 - Union-Find
Lecture 53 - Augmented disjoint set data structure
Lecture 54 - Network flow
Lecture 55 - Network Flow (Continued...)
```

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NPTEL Video Course - Computer Science and Engineering - NOC:Hardware Modeling using Verilog

Subject Co-ordinator - Prof. Indranil Sengupta

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1
Lecture 2
Lecture 3
Lecture 4
Lecture 5
Lecture 6 - Verilog Language Features - Part 1
Lecture 7 - Verilog Language Features - Part 2
Lecture 8 - Verilog Language Features - Part 3
Lecture 9 - Verilog Operators
Lecture 10 - Verilog Modeling Examples
Lecture 11 - Verilog Modeling Examples (Continued...)
Lecture 12 - Verilog Description Styles
Lecture 13 - Procedural Assignment
Lecture 14 - Procedural Assignment (Continued...)
Lecture 15 - Procedural Assignment (Examples)
Lecture 16 - Blocking / Non-Blocking Assignments - Part 1
Lecture 17 - Blocking / Non-Blocking Assignments - Part 2
Lecture 18 - Blocking / Non-Blocking Assignments - Part 3
Lecture 19 - Blocking / Non-Blocking Assignments - Part 4
Lecture 20 - User Defined Primitives
Lecture 21 - Verilog Test Bench
Lecture 22 - Writing Verilog Test Benches
Lecture 23 - Modeling Finite State Machines
Lecture 24 - Modeling Finite State Machines (Continued...)
Lecture 25 - Datapath And Controller Design - Part 1
Lecture 26 - Datapath And Controller Design - Part 2
Lecture 27 - Datapath And Controller Design - Part 3
Lecture 28 - Synthesizable Verilog
Lecture 29 - Some Recommended Practices

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```
Lecture 30 - Modeling Memory
Lecture 31 - Modeling Register Banks
Lecture 32 - Basic Pipelining Concepts
Lecture 33 - Pipeline Modeling - Part 1
Lecture 34 - Pipeline Modeling - Part 2
Lecture 35 - Switch Level Modeling - Part 1
Lecture 36 - Switch Level Modeling - Part 2
Lecture 37 - Pipeline Implementation Of A Processor - Part 1
Lecture 38 - Pipeline Implementation Of A Processor - Part 2
Lecture 39 - Pipeline Implementation Of A Processor - Part 3
Lecture 40 - Verilog Modeling Of The Processor - Part 1
Lecture 41 - Verilog Modeling Of The Processor - Part 2
```

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NPTEL Video Course - Computer Science and Engineering - NOC:Introduction to Internet of Things

Subject Co-ordinator - Prof. Sudip Misra

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to IoT- Part I
Lecture 2 - Introduction to IoT- Part II
Lecture 3 - Sensing
Lecture 4 - Actuation
Lecture 5 - Basics of IoT Networking - Part I
Lecture 6 - Basics of IoT Networking - Part II
Lecture 7 - Basics of IoT Networking - Part III
Lecture 8 - Basics of IoT Networking - Part IV
Lecture 9 - Connectivity Technologies - Part I
Lecture 10 - Connectivity Technologies - Part II
Lecture 11
Lecture 12
Lecture 13
Lecture 14
Lecture 15
Lecture 16
Lecture 17
Lecture 18
Lecture 19
Lecture 20
Lecture 21
Lecture 22
Lecture 23
Lecture 24
Lecture 25
Lecture 26 - Introduction to Python Programming - I
Lecture 27 - Introduction to Python Programming - II
Lecture 28 - Introduction to Raspberry Pi - I
Lecture 29 - Introduction to Raspberry Pi - II

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Lecture 30 - Implementation of IoT with Raspberry Pi - I
Lecture 31
Lecture 32
Lecture 33
Lecture 34
Lecture 35
Lecture 36 - Software Defined IoT Networking - II
Lecture 37 - Cloud Computing-Fundamental
Lecture 38 - Cloud Computing-Service Model
Lecture 39 - Cloud Computing-Service Management and Security
Lecture 40 - Cloud Computing - Case Studies
Lecture 41 - Cloud Computing - Practical
Lecture 42 - Sensor-Cloud - I
Lecture 43 - Sensor-Cloud - II
Lecture 44 - Fog Computing - I
Lecture 45 - Fog Computing - II
Lecture 46 - Smart Cities and Smart Homes - I
Lecture 47 - Smart Cities and Smart Homes - II
Lecture 48 - Smart Cities and Smart Homes - III
Lecture 49 - Connected Vehicles - I
Lecture 50 - Connected Vehicles - II
Lecture 51 - Smart Grid - I
Lecture 52 - Smart Grid - II
Lecture 53 - Industrial Internet of Things - I
Lecture 54 - Industrial Internet of Things - II
Lecture 55 - Data Handling and Analytics - I
Lecture 56 - Data Handling and Analytics - II
Lecture 57 - Case Study
Lecture 58 - Case Study
Lecture 59 - Case Study
Lecture 60 - Case Study
```

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NPTEL Video Course - Computer Science and Engineering - NOC:Cloud Computing

Subject Co-ordinator - Prof. Soumya Kanti Ghosh

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Cloud Computing Overview
Lecture 2 - Cloud Computing Overview (Continued...)
Lecture 3 - Cloud Computing - Introduction
Lecture 4 - Cloud Computing Architecture
Lecture 5 - Cloud Computing Architecture (Continued...)
Lecture 6 - Cloud Computing Architecture - Deployment Models
Lecture 7 - Cloud Computing Virtualization
Lecture 8 - Cloud Computing XML Basics
Lecture 9 - Cloud Computing XML Basics - II
Lecture 10 - Cloud Computing Web Services, Service Oriented Architecture
Lecture 11 - Service Level Agreement
Lecture 12 - Cloud Economics
Lecture 13 - Managing Data
Lecture 14 - Introduction to MapReduce
Lecture 15 - Open Stack
Lecture 16 - Cloud Computing - Opensource Cloud - Openstack Demo
Lecture 17 - Cloud Computing Case Study with a commercial Cloud - Microsoft Azure
Lecture 18 - Cloud Computing Demo - Microsoft Azure
Lecture 19 - Cloud Computing Case Study - Google Cloud Platform (GCP)
Lecture 20 - Cloud Computing Demo - Google Cloud Platform (GCP)
Lecture 21 - SLA-Tutorial
Lecture 22 - Cloudonomics-Tutorial
Lecture 23 - MapReduce-Tutorial
Lecture 24 - Resource Management - I
Lecture 25 - Resource Management - II
Lecture 26 - Cloud Computing: Security - I
Lecture 27 - Cloud Computing: Security - II
Lecture 28 - Cloud Computing: Security - III
Lecture 29 - Cloud Computing: Security Issues in Collaborative SaaS Cloud

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Lecture 30 - Cloud Computing: Broker for Cloud Marketplace
Lecture 31 - Mobile Cloud Computing - I
Lecture 32 - Mobile Cloud Computing - II
Lecture 33 - Fog Computing - I
Lecture 34 - Fog Computing - II
Lecture 35 - Use Case-Geo-spatial Cloud
Lecture 36 - Introduction to DOCKER Container
Lecture 37 - Green Cloud
Lecture 38 - Sensor Cloud Computing
Lecture 39 - IoT Cloud
Lecture 40 - Course Summary and Research Areas
Lecture 41 - Cloud-Fog Computing - Overview
Lecture 42 - Resource Management - I
Lecture 43 - Resource Management - II
Lecture 44 - Cloud Federation
Lecture 45 - VM Migration - Basics Migration strategies
Lecture 46 - VM Migration - Basics Migration strategies
Lecture 47 - Containers Container based Virtualization Kubernetes Docker Container
Lecture 48 - Docker Container - Overview Docker - Components Docker - Architecture
Lecture 49 - Docker Container - Demo
Lecture 50 - Docker Container - Demo
Lecture 51 - Dew Computing
Lecture 52 - Serverless Computing - I
Lecture 53 - Serverless Computing - II
Lecture 54 - Sustainable Cloud Computing - I
Lecture 55 - Sustainable Cloud Computing - II
Lecture 56 - Cloud Computing in 5G Era
Lecture 57 - CPS and Cloud Computing
Lecture 58 - Case Study I (Spatial Cloud Computing)
Lecture 59 - Case Study II (Internet of Health Things) - Part A
Lecture 60 - Case Study II (Internet of Health Things) - Part B
```

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NPTEL Video Course - Computer Science and Engineering - NOC:Problem Solving through Programming in C

Subject Co-ordinator - Prof.Arnab sarkar, Prof.Jatindra Kumar Deka, Dr. Santosh Biswas

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction
Lecture 2 - Idea of Algorithms
Lecture 3 - Flow Chart and Pseudocode
Lecture 4 - Introduction to Programming Language Concepts
Lecture 5 - Variables and Memory
Lecture 6 - Types of Software and Compilers
Lecture 7 - Introduction to C Programming Language
Lecture 8 - Variables and Variable Types in C
Lecture 9 - Introducing Functions
Lecture 10 - Address and Content of Variables and Types
Lecture 11 - Assignment Statement and Operators in C
Lecture 12 - Arithmetic Expressions and Relational Expressions
Lecture 13 - Logical Operators and Change in Control Flow
Lecture 14 - Use of Logical Operaotrs in Branching
Lecture 15 - Branching
Lecture 16 - IF-ELSE Statement (Continued...)
Lecture 17 - Switch statement
Lecture 18 - Switch Statement (Continued...) and Introduction to Loops
Lecture 19 - Implementing Repetitions (Loops)
Lecture 20 - Implementation of Loops with for Statement (Continued...)
Lecture 21 - For Statement (Continued...)
Lecture 22 - Example of If-Else
Lecture 23 - Example of Loops
Lecture 24 - Example of Loops (Continued...)
Lecture 25 - Example of Loops (Continued...), Use of FOR Loops
Lecture 26 - Introduction to Arrays
Lecture 27 - Arrays (Continued...)
Lecture 28 - Arrays (Continued...)
Lecture 29 - Program using Arrays

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Lecture 30 - Array Problem
Lecture 31 - Linear Search
Lecture 32 - Character Array and Strings
Lecture 33 - String Operations
Lecture 34 - 2-D Array Operation
Lecture 35 - Introducing Functions
Lecture 36 - More on Functions
Lecture 37 - Function (Continued...)
Lecture 38 - Scanf and Printf Functions; Function Prototype
Lecture 39 - Parameter Passing in Function Revision
Lecture 40 - Parameter Passing in Function Revision (Continued...)
Lecture 41 - Substitution of # include and Macro
Lecture 42 - search as a function
Lecture 43 - Binary Search
Lecture 44 - Binary Search (Continued...)
Lecture 45 - Sorting Methods
Lecture 46 - Bubble Sort (Continued...)
Lecture 47 - Use of Pointer in Function
Lecture 48 - Arrays at Strings
Lecture 49 - Data Representation
Lecture 50 - Bisection Method
Lecture 51 - Interpolation
Lecture 52 - Trapezoidal Rule and Runge-Kutta Method
Lecture 53 - Recursion
Lecture 54 - Recursion (Continued...)
Lecture 55 - Structure
Lecture 56 - Structure (Continued...)
Lecture 57 - Structure with typedef
Lecture 58 - Pointer
Lecture 59 - Pointer (Continued...)
Lecture 60 - Pointer in Structures
Lecture 61 - Dynamic Allocation and File
```

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NPTEL Video Course - Computer Science and Engineering - NOC:Real Time Operating System

Subject Co-ordinator - Prof. Rajib Mall

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction
Lecture 2 - Basics of Tast scheduling
Lecture 3 - Cyclic executives
Lecture 4 - Cyclic Scheduler
Lecture 5 - Cyclic Scheduler
Lecture 6 - Exercises on Frame size Selectoin
Lecture 7 - Event-driven schedulers
Lecture 8 - Rate Monotonic Algorithm
Lecture 9 - RMA Task Schedulability
Lecture 10 - Rate Monotonic Analysis
Lecture 11 - RMA Generalizations
Lecture 12 - Further RMA Generalizations
Lecture 13 - Resource Sharing among Real-Time Tasks
Lecture 14 - Solution to Priority Inversion Problem
Lecture 15 - Highest Locker Protocol
Lecture 16 - Priority Ceiling Protocol
Lecture 17 - PCP Priority Inversions
Lecture 18 - Analysis of PCP priority inversions
Lecture 19 - Some basic issues in Real-Time Operating Systems
Lecture 20 - Unix as a Real-Time operating System

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NPTEL Video Course - Computer Science and Engineering - NOC:Introduction to Soft Computing

Subject Co-ordinator - Prof. Debasis Samanta

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to soft computing
Lecture 2 - Introduction to Fuzzy Logic
Lecture 3 - Fuzzy membership functions (Continued...) and Defining Membership functions
Lecture 4 - Fuzzy operations
Lecture 5 - Fuzzy relations
Lecture 6 - Fuzzy Relations (Continued...) and Fuzzy propositions
Lecture 7 - Fuzzy implications
Lecture 8 - Fuzzy Inferences
Lecture 9 - Defuzzification techniques (Part-I)
Lecture 10 - Defuzzification Techniques (Part-I) (Continued...)
Lecture 11 - Fuzzy logic controller
Lecture 12 - Fuzzy Logic Controller (Continued...)
Lecture 13 - Fuzzy logic controller (Continued...)
Lecture 14 - Concept of Genetic Algorithm
Lecture 15 - Concept of Genetic Algorithm (Continued...) and GA Strategies
Lecture 16 - GA Operator
Lecture 17 - GA operator
Lecture 18 - GA Operator
Lecture 19 - GA Operator
Lecture 20 - GA Operator
Lecture 21 - GA Operator
Lecture 22 - GA Operator
Lecture 23 - GA Operator
Lecture 24 - Multi-objective optimization problem solving
Lecture 25 - Multi-objective optimization problem solving (Continued...)
Lecture 26 - Concept of domination
Lecture 27 - Non-Pareto based approaches to solve MOOPs
Lecture 28 - Non-Pareto based approaches to solve MOOPs (Continued...)
Lecture 29 - Pareto-Based approaches to solve MOOPs

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```
Lecture 30 - Pareto-based approaches to solve MOOPs (Continued....)
Lecture 31 - Pareto-based approach to solve MOOPs
Lecture 32 - Pareto-based approach to solve MOOPs (Continued...)
Lecture 33 - Pareto-based approach to solve MOOPs (Continued...)
Lecture 34 - Introduction to Artificial Neural Network
Lecture 35 - ANN Architectures
Lecture 36 - Training ANNs
Lecture 37 - Training ANNs (Continued....)
Lecture 38 - Training ANNs (Continued....)
Lecture 39 - Training ANNs (Continued....)
Lecture 40 - Soft computing tools
```

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NPTEL Video Course - Computer Science and Engineering - NOC:Data Mining

Subject Co-ordinator - Prof. Pabitra Mitra

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction, Knowledge Discovery Process
Lecture 2 - Data Preprocessing - I
Lecture 3 - Data Preprocessing - II
Lecture 4 - Association Rules
Lecture 5 - Apriori algorithm
Lecture 6 - Rule generation
Lecture 7 - Classification
Lecture 8 - Decision Tree - I
Lecture 9 - Decision Tree - II
Lecture 10 - Decision Tree - III
Lecture 11 - Decision Tree - IV
Lecture 12 - Bayes Classifier - I
Lecture 13 - Bayes Classifier - II
Lecture 14 - Bayes Classifier - III
Lecture 15 - Bayes Classifier - IV
Lecture 16 - Bayes Classifier - V
Lecture 17 - K Nearest Neighbor - I
Lecture 18 - K Nearest Neighbor - II
Lecture 19
Lecture 20
Lecture 21
Lecture 22 - Support Vector Machine - I
Lecture 23 - Support Vector Machine - II
Lecture 24 - Support Vector Machine - III
Lecture 25 - Support Vector Machine - IV
Lecture 26 - Support Vector Machine - V
Lecture 27 - Kernel Machines
Lecture 28 - Artificial Neural Networks - I
Lecture 29 - Artificial Neural Networks - II

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Lecture 30 - Artificial Neural Networks - III
Lecture 31 - Artificial Neural Networks - IV
Lecture 32 - Clustering - I
Lecture 33 - Clustering - II
Lecture 34 - Clustering - III
Lecture 35 - Clustering - IV
Lecture 36 - Clustering - V
Lecture 37 - Regression - I
Lecture 38 - Regression - II
Lecture 39 - Regression - III
Lecture 40 - Regression - IV
Lecture 41 - Dimensionality Reduction - I
Lecture 42 - Dimensionality Reduction - II
Lecture 43 - Tutorial
Lecture 44 - Live Session
```

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NPTEL Video Course - Computer Science and Engineering - NOC:Data Base Management System

Subject Co-ordinator - Prof. Partha Pratim Das

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable


```
Lecture 1 - Course Overview
Lecture 2 - Introduction to DBMS/1
Lecture 3 - Introduction to DBMS/2
Lecture 4 - Introduction to Relational Model/1
Lecture 5 - Introduction to Relational Model/2
Lecture 6 - Introduction to SQL/1
Lecture 7 - Introduction to SQL/2
Lecture 8 - Introduction to SQL/3
Lecture 9 - Intermediate SQL/1
Lecture 10 - Intermediate SQL/2
Lecture 11 - Advanced SQL
Lecture 12 - Formal Relational Query Languages
Lecture 13 - Entity-Relationship Model/1
Lecture 14 - Entity-Relationship Model/2
Lecture 15 - Entity-Relationship Model/3
Lecture 16 - Relational Database Design
Lecture 17 - Relational Database Design (Continued...)
Lecture 18 - Relational Database Design/3
Lecture 19 - Relational Database Design (Continued...)
Lecture 20 - Relational Database Design/5
Lecture 21 - Application Design and Development/1
Lecture 22 - Application Design and Development/2
Lecture 23 - Application Design and Development/3
Lecture 24 - Storage and File Structure/1
Lecture 25 - Storage and File Structure/2
Lecture 26 - Indexing and Hashing/1
Lecture 27 - Indexing and Hashing/2
Lecture 28 - Indexing and Hashing/3
Lecture 29 - Indexing and Hashing/4
```

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```
Lecture 30 - Indexing and Hashing/5
Lecture 31 - Transactions/1
Lecture 32 - Transactions/2
Lecture 33 - Transactions/3
Lecture 34 - Concurrency Control/1
Lecture 35 - Concurrency Control/2
Lecture 36 - Recovery/1
Lecture 37 - Recovery/2
Lecture 38 - Query Processing and Optimization/1
Lecture 39 - Query Processing and Optimization/2
Lecture 40 - Course Summarization
Lecture 41 - Live Session
Lecture 42 - Live Session - 2
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NPTEL Video Course - Computer Science and Engineering - NOC:Software Engineering

Subject Co-ordinator - Prof. Rajib Mall

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction - I
Lecture 2 - Introduction - II
Lecture 3 - Introduction - III
Lecture 4 - Introduction - IV
Lecture 5 - Introduction - V
Lecture 6 - Life Cycle Model
Lecture 7 - Life Cycle Model
Lecture 8 - Waterfall Model
Lecture 9 - Waterfall Derivatives
Lecture 10 - Incremental Model
Lecture 11 - Evolutionary Model
Lecture 12 - Agile Model
Lecture 13 - Extreme Programming and Scrum
Lecture 14 - Scrum
Lecture 15 - Introduction to requirement specification
Lecture 16 - Requirement gathering and analysis
Lecture 17 - Functional requirements
Lecture 18 - Representation of complex programming logic
Lecture 19 - Design Fundamentals
Lecture 20 - Modular Design
Lecture 21 - Classification of Cohesion
Lecture 22 - Classification of Coupling
Lecture 23 - Introduction to structured analysis and structured design
Lecture 24 - Basics of Data Flow Diagrams (DFD)
Lecture 25 - Developing DFD Model
Lecture 26 - Examples of DFD Model development
Lecture 27 - DFD Model - More Examples
Lecture 28 - Essentials of Structure Chart
Lecture 29 - Transform Analysis, Transaction Analysis

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Lecture 30 - Structured Design Examples
Lecture 31 - Use Case Modelling
Lecture 32 - Factoring Use Cases
Lecture 33 - Overview of Class diagram
Lecture 34 - Inheritance relationship
Lecture 35 - Association relationship
Lecture 36 - Aggregation/ Composition and dependency relations
Lecture 37 - Interation Modelling
Lecture 38 - Development of Sequence diagrams
Lecture 39 - State-Machine diagram
Lecture 40 - An Object-Oriented design process
Lecture 41 - Domain Analysis
Lecture 42 - Examples of object-oriented design
Lecture 43 - Basic concepts in Testing - I
Lecture 44 - Basic concepts in Testing - II
Lecture 45 - Basic concepts in Testing - III
Lecture 46 - Unit testing strategies - I
Lecture 47 - Unit testing strategies - II
Lecture 48 - Equivalance Class Testing - I
Lecture 49 - Equivalance Class Testing - II
Lecture 50 - Special Value Testing
Lecture 51 - Combinatorial Testing
Lecture 52 - Decision Table Testing
Lecture 53 - Cause effect graphing
Lecture 54 - Pairwise Testing
Lecture 55 - White box Testing
Lecture 56 - Condition Testing
Lecture 57 - MC/DC Coverage
Lecture 58 - MC/DC Testing
Lecture 59 - Path Testing
Lecture 60 - Dataflow and Mutation Testing
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NPTEL Video Course - Computer Science and Engineering - NOC:Computer Networks and Internet Protocol

Subject Co-ordinator - Prof. Sandip Chakraborty, Prof. Soumya Kanti Ghosh

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to Computer Networks - A brief history
Lecture 2 - Data Networks - from Circuit Switching Network to Packet Switching Network
Lecture 3 - Network Protocol Stack
Lecture 4 - Services at the Different Layers of the Protocol Stack
Lecture 5 - Application Layer I - Different Protocols at the Application Layer
Lecture 6 - Application Layer II - Domain Name Systems
Lecture 7 - Application Layer III - The Web
Lecture 8 - Application Layer III - Hypertext Transfer Protocol
Lecture 9 - Application Layer III - Internet Mail Transfer
Lecture 10 - Application Layer IV - File Transfer (FTP)
Lecture 11 - Transport Layer I - Services
Lecture 12 - Transport Layer II - Connection
Lecture 13 - Transport Layer II - Connection (Continued...)
Lecture 14 - Transport Layer IV - Reliability
Lecture 15 - Transport Layer V - Sliding Window Protocols
Lecture 16 - Transport Layer Performance
Lecture 17 - Buffer Management and Congestion Control
Lecture 18 - Transport Layer Primitives
Lecture 19 - Transmission Control Protocol I - Basics
Lecture 20 - Transmission Control Protocol II - Connections
Lecture 21 - Transmission Control Protocol III - Flow Control
Lecture 22 - Transmission Control Protocol IV - Congestion Control
Lecture 23 - User Datagram Protocol
Lecture 24 - Socket Programming - I
Lecture 25 - Socket Programming - II
Lecture 26 - Network Layer I - Introduction
Lecture 27 - IP Addressing (IPv4) I - Classful addressing
Lecture 28 - IP Addressing (IPv4) II - CIDR
Lecture 29 - IP Addressing (IPv4) III - Network Address Translation (NAT)

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Lecture 30 - IPv6 Addressing
Lecture 31 - Internet QoS - I (What is QoS)
Lecture 32 - Internet QoS - II (Basic QoS Architecture)
Lecture 33 - Internet QoS - III (Traffic Policing and Traffic Shaping)
Lecture 34 - Internet QoS - IV (Traffic Scheduling)
Lecture 35 - Internet QoS - V (Integrated and Differentiated Service Architecture)
Lecture 36 - IP Routing Table
Lecture 37 - Routing in the Internet I - Intra-domain routing
Lecture 38 - Routing in the Internet II - Routing protocols
Lecture 39 - Routing in the Internet III - Inter-domain Routing
Lecture 40 - Routing in the Internet IV - Border Gateway Protocol
Lecture 41 - IP Routers
Lecture 42 - IP Routers Demo
Lecture 43 - Software Defined Networking - I (Basics)
Lecture 44 - Software Defined Networking - II (Open Flow)
Lecture 45 - Software Defined Networking - III (Demo)
Lecture 46 - Data Link Layer - Overview
Lecture 47 - Data Link Layer - Basic Concepts
Lecture 48 - Data Link Layer - Ethernet
Lecture 49 - Data Link Layer - Ethernet (Continued...)
Lecture 50 - Data Link Layer - Flow and Error Control
Lecture 51 - ARP-RAPP-BOOTP-DHCP
Lecture 52 - ARP-RAPP-BOOTP-DHCP (Continued...)
Lecture 53
Lecture 54 - Wireless LANs
Lecture 55 - Layer 1
Lecture 56 - Layer 1
Lecture 57 - Layer 1
Lecture 58 - Network Security - Overview
Lecture 59 - Network Security - II
Lecture 60 - Network Security - III [TCP/IP Security]
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NPTEL Video Course - Computer Science and Engineering - NOC:Blockchain Architecture Design and Use Cases

Subject Co-ordinator - Praveen Jayachandran, Prof. Sandip Chakraborty

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to Blockchain - I (Basics)
Lecture 2 - Introduction to Blockchain - II (History)
Lecture 3 - Introduction to Blockchain - III (Architecture)
Lecture 4 - Introduction to Blockchain - IV (Conceptualization)
Lecture 5 - Basic Crypto Primitives - I
Lecture 6 - Basic Crypto Primitives - II
Lecture 7 - Bitcoin Basics - I
Lecture 8 - Bitcoin Basics - II
Lecture 9 - Bitcoin Basics - III
Lecture 10 - Distributed Consensus
Lecture 11 - Consensus in Bitcoin - I (The Basics)
Lecture 12 - Consensus in Bitcoin - II (PoW and Beyond)
Lecture 13 - Consensus in Bitcoin - III (The Miners)
Lecture 14 - Permissioned Blockchain - I (Basics)
Lecture 15 - Permissioned Blockchain - II (Consensus)
Lecture 16 - Permissioned Blockchain - III (RAFT Consensus)
Lecture 17 - Permissioned Blockchain - IV (Byzantine General Problem)
Lecture 18 - Permissioned Blockchain - V (Practical Byzantine Fault Tolerance)
Lecture 19 - Blockchain for Enterprise - Overview
Lecture 20 - Blockchain Components and Concepts
Lecture 21 - Hyperledger Fabric - Transaction Flow
Lecture 22 - Hyperledger Fabric Details
Lecture 23 - Fabric - Membership and Identity Management
Lecture 24 - Hyperledger Fabric Network Setup
Lecture 25 - Fabric Demo on IBM Blockchain Cloud - I
Lecture 26 - Fabric Demo on IBM Blockchain Cloud - II
Lecture 27 - Fabric Demo, deploy from scratch - III
Lecture 28 - Hyperledger Composer - Application Development
Lecture 29 - Hyperledger Composer - Network Administration

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Lecture 30 - Blockchain Use Cases
Lecture 31 - Blockchain in Financial Service - I (Payments and Secure Trading)
Lecture 32 - Blockchain in Financial Service - II (Compliance and Mortgage)
Lecture 33 - Blockchain in Financial Service - III (Financial Trade)
Lecture 34 - Revolutionizing Global Trade
Lecture 35 - Blockchain in Supply Chain - I
Lecture 36 - Blockchain in Supply Chain - II
Lecture 37 - Blockchain in Other Industries
Lecture 38 - Blockchain in Government - I (Advantages)
Lecture 39 - Blockchain in Government - II (Use Cases)
Lecture 40 - Blockchain in Government - III (Digital Identity)
Lecture 41 - Blockchain in Government - IV (Hyperledger Indy)
Lecture 42 - Blockchain in Government - V (Tax Payments and Land Registry Records)
Lecture 43 - Blockchain Security - I (Overview)
Lecture 44 - Blockchain Security - II (Membership and Access control in Fabric)
Lecture 45 - Blockchain Security - III (Privacy in Fabric)
Lecture 46 - Blockchain Security - III (Fabric SideDB)
Lecture 47 - Research Aspects - I (Consensus Scalability)
Lecture 48 - Research Aspects - II (Bitcoin-NG)
Lecture 49 - Research Aspects - III (Collective Signing)
Lecture 50 - Research Aspects - IV (Byzcoin)
Lecture 51 - Research Aspects - V (Algorand)
Lecture 52 - Research Aspects - VI (Cross Fault Tolerance)
Lecture 53 - Research Aspects - VII (Secured Multi-Party Computation)
Lecture 54 - Blockchain for Science - I (Blockchain for Big Data)
Lecture 55 - Blockchain for Science - II (Blockchain and AI)
Lecture 56 - Comparing Ecosystems - Ethereum
Lecture 57 - Comparing Ecosystems - Ethereum development tools and Quorum
Lecture 58 - Comparing Ecosystems - Corda Part 1
Lecture 59 - Comparing Ecosystems - Corda Part 2
Lecture 60 - Concluding the course
```

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NPTEL Video Course - Computer Science and Engineering - NOC:Switching Circuits and Logic Design

Subject Co-ordinator - Prof. Indranil Sengupta

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction
Lecture 2 - Octal and Hexadecimal Number Systems
Lecture 3 - Signed and Unsigned Binary Number Representation
Lecture 4 - Binary Addition and Subtraction
Lecture 5 - BCD and Gray Code Representations
Lecture 6 - Error Detection and Correction
Lecture 7 - Logic Gates
Lecture 8 - Logic Families to Implement Gates
Lecture 9 - Emerging Technologies - Part I
Lecture 10 - Emerging Technologies - Part II
Lecture 11 - Switching Algebra
Lecture 12 - Algebraic Manipulation
Lecture 13 - Properties of Switching Functions
Lecture 14 - Obtaining Canonical Representations of Functions
Lecture 15 - Functional Completeness
Lecture 16 - Minimization Using Karnaugh Maps - Part I
Lecture 17 - Minimization Using Karnaugh Maps - Part II
Lecture 18 - Minimization Using Karnaugh Maps - Part III
Lecture 19 - Minimization using Tabular Method - Part I
Lecture 20 - Minimization using Tabular Method - Part II
Lecture 21 - Design of Adders - Part I
Lecture 22 - Design of Adders - Part II
Lecture 23 - Design of Adders - Part III
Lecture 24 - Logic Design - Part I
Lecture 25 - Logic Design - Part II
Lecture 26 - Logic Design - Part III
Lecture 27 - Binary Decision Diagrams - Part I
Lecture 28 - Binary Decision Diagrams - Part II
Lecture 29 - Logic Design using AND-EXOR Network

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Lecture 30 - Threshold Logic and Threshold Gates
Lecture 31 - Latches and Flip-Flops - Part I
Lecture 32 - Latches and Flip-Flops - Part II
Lecture 33 - Latches and Flip-Flops - Part III
Lecture 34 - Clocking and Timing - Part I
Lecture 35 - Clocking and Timing - Part II
Lecture 36 - Synthesis of Synchronous Sequential Circuits - Part I
Lecture 37 - Synthesis of Synchronous Sequential Circuits - Part II
Lecture 38 - Synthesis of Synchronous Sequential Circuits - Part III
Lecture 39 - Synthesis of Synchronous Sequential Circuits - Part IV
Lecture 40 - Minimization of Finite State Machines - Part I
Lecture 41 - Minimization of Finite State Machines - Part II
Lecture 42 - Design of Registers - Part I
Lecture 43 - Design of Registers - Part II
Lecture 44 - Design of Registers - Part III
Lecture 45 - Design of Counters - Part I
Lecture 46 - Design of Counters - Part II
Lecture 47 - Digital-to-Analog Converter - Part I
Lecture 48 - Digital-to-Analog Converter - Part II
Lecture 49 - Analog-to-Digital Converter - Part I
Lecture 50 - Analog-to-Digital Converter - Part II
Lecture 51 - Analog-to-Digital Converter - Part III
Lecture 52 - Asynchronous Sequential Circuits - Part I
Lecture 53 - Asynchronous Sequential Circuits - Part II
Lecture 54 - Algorithmic State Machine (ASM Chart
Lecture 55 - Testing of Digital Circuits
Lecture 56 - Fault Modeling
Lecture 57 - Test Pattern Generation
Lecture 58 - Design for Testability
Lecture 59 - Built-in Self-Test - Part I
Lecture 60 - Built-in Self-Test - Part II
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NPTEL Video Course - Computer Science and Engineering - NOC:Scalable Data Science

Subject Co-ordinator - Prof. Sourangshu Bhattacharya, Prof. Anirban Dasgupta

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Background
Lecture 2 - Probability
Lecture 3 - Linear algebra
Lecture 4 - Optimization
Lecture 5 - Machine Learning
Lecture 6 - Memory-efficient data structures
Lecture 7 - Bloom filters
Lecture 8 - Sketches for distinct count
Lecture 9 - Sketches for distinct count (Continued...)
Lecture 10 - Misra-Gries sketch
Lecture 11 - Frequent Element
Lecture 12 - Frequent Element
Lecture 13 - Near Neighbors
Lecture 14 - Locality Sensitive Hashing
Lecture 15 - Building LSH Tables
Lecture 16 - Approximate near neighbors search
Lecture 17 - Approximate near neighbors search
Lecture 18 - Approximate near neighbors search
Lecture 19 - Randomized Numerical Linear Algebra
Lecture 20 - Randomized Numerical Linear Algebra
Lecture 21 - Randomized Numerical Linear Algebra
Lecture 22 - Randomized Numerical Linear Algebra
Lecture 23 - Randomized Numerical Linear Algebra
Lecture 24 - Randomized Numerical Linear Algebra
Lecture 25 - Randomized Numerical Linear Algebra
Lecture 26 - Map-reduce and Hadoop
Lecture 27 - Hadoop System
Lecture 28 - Hadoop System (Continued...)
Lecture 29 - Hadoop System (Continued...)

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Lecture 30 - Spark
Lecture 31 - Spark (Continued...)
Lecture 32 - Spark (Continued...)
Lecture 33 - Distributed Machine Learning and Optimization
Lecture 34 - SGD+Proof
Lecture 35 - SGD+Proof (Continued...)
Lecture 36 - Distributed Machine Learning and Optimization
Lecture 37 - Distributed Machine Learning and Optimization
Lecture 38 - Clustering
Lecture 39 - Clustering (Continued...)
Lecture 40 - Conclusion
```

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NPTEL Video Course - Computer Science and Engineering - NOC:Compiler Design

Subject Co-ordinator - Prof. Santanu Chattopadhyay

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction
Lecture 2 - Introduction (Continued...)
Lecture 3 - Introduction (Continued...)
Lecture 4 - Introduction (Continued...)
Lecture 5 - Introduction (Continued...)
Lecture 6 - Introduction (Continued...)
Lecture 7 - Lexical Analysis
Lecture 8 - Lexical Analysis (Continued...)
Lecture 9 - Lexical Analysis (Continued...)
Lecture 10 - Lexical Analysis (Continued...)
Lecture 11 - Lexical Analysis (Continued...)
Lecture 12 - Lexical Analysis (Continued...)
Lecture 13 - Lexical Analysis (Continued...)
Lecture 14 - Lexical Analysis (Continued...)
Lecture 15 - Lexical Analysis (Continued...)
Lecture 16 - Parser
Lecture 17 - Parser (Continued...)
Lecture 18 - Parser (Continued...)
Lecture 19 - Parser (Continued...)
Lecture 20 - Parser (Continued...)
Lecture 21 - Parser (Continued...)
Lecture 22 - Parser (Continued...)
Lecture 23 - Parser (Continued...)
Lecture 24 - Parser (Continued...)
Lecture 25 - Parser (Continued...)
Lecture 26 - Parser (Continued...)
Lecture 27 - Parser (Continued...)
Lecture 28 - Parser (Continued...)
Lecture 29 - Parser (Continued...)

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Lecture 30 - Parser (Continued...)
Lecture 31 - Parser (Continued...)
Lecture 32 - SR Latch and Introduction to Clocked Flip-Flop
Lecture 33 - Edge-Triggered Flip-Flop
Lecture 34 - Representations of Flip-Flops
Lecture 35 - Analysis of Sequential Logic Circuit
Lecture 36 - Conversion of Flip-Flops and Flip-Flop Timing Parameters
Lecture 37 - Register and Shift Register
Lecture 38 - Shift Register
Lecture 39 - Application of Shift Register
Lecture 40 - Linear Feedback Shift Register
Lecture 41 - Serial Addition, Multiplication and Division
Lecture 42 - Type Checking (Continued...)
Lecture 43 - Symbol Table
Lecture 44 - Symbol Table (Continued...)
Lecture 45 - Symbol Table (Continued...)
Lecture 46 - Symbol Table (Continued...) and Runtime Environment
Lecture 47 - Runtime Environment
Lecture 48 - Runtime Environment (Continued...)
Lecture 49 - Runtime Environment (Continued...)
Lecture 50 - Intermediate Code Generation
Lecture 51 - Intermediate Code Generation (Continued...)
Lecture 52 - Intermediate Code Generation (Continued...)
Lecture 53 - Intermediate Code Generation (Continued...)
Lecture 54 - Intermediate Code Generation (Continued...)
Lecture 55 - Intermediate Code Generation (Continued...)
Lecture 56 - Intermediate Code Generation (Continued...)
Lecture 57 - Intermediate Code Generation (Continued...)
Lecture 58 - Intermediate Code Generation (Continued...)
Lecture 59 - Intermediate Code Generation (Continued...)
Lecture 60 - Intermediate Code Generation (Continued...)
Lecture 61 - Intermediate Code Generation (Continued...)
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NPTEL Video Course - Computer Science and Engineering - NOC:Programming in Java

Subject Co-ordinator - Prof. Debasis Samanta

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction
Lecture 2 - Java Programming Steps
Lecture 3 - Java Tools and Resources
Lecture 4 - Demonstration - I
Lecture 5 - Java Applet Programming
Lecture 6 - Demonstration - II
Lecture 7 - Encapsulation
Lecture 8 - Demonstration - III
Lecture 9 - Java Programming Insights
Lecture 10 - Demonstration - IV
Lecture 11 - Java Static Scope Rule
Lecture 12 - Demonstration - V
Lecture 13 - Inheritance
Lecture 14 - Demonstration - VI
Lecture 15 - Information Hiding
Lecture 16 - Demonstration - VII
Lecture 17 - Packages - I
Lecture 18 - Packages - II
Lecture 19 - Demonstration - VIII
Lecture 20 - Interface - I
Lecture 21 - Interface - II
Lecture 22 - Demonstration - IX
Lecture 23 - Exception Handling - I
Lecture 24 - Exception Handling - II
Lecture 25 - Exception Handling - III
Lecture 26 - Demonstration - X
Lecture 27 - Multithreading - I
Lecture 28 - Multithreading - II
Lecture 29 - Demonstration - XI

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Lecture 30 - I-O Stream - I
Lecture 31 - I-O Stream - II
Lecture 32 - I-O Stream - III
Lecture 33 - Demonstration - XII
Lecture 34 - Applet Programming - I
Lecture 35 - Applet Programming - II
Lecture 36 - Applet Programming - III
Lecture 37 - Demonstration - XIII
Lecture 38 - Demonstration - XIV
Lecture 39 - AWT Programming - I
Lecture 40 - AWT Programming - II
Lecture 41 - Demonstration - XV
Lecture 42 - AWT Programming - III
Lecture 43 - Swing - I
Lecture 44 - Swing - II
Lecture 45 - Demonstration - XVI
Lecture 46 - Demonstration - XVII
Lecture 47 - Demonstration - XVIII
Lecture 48 - Networking with Java
Lecture 49 - Demonstration - XIX
Lecture 50 - JDBC - I
Lecture 51 - JDBC - II
Lecture 52 - JDBC - III
Lecture 53 - Demonstration - XX
Lecture 54 - Demonstration - XXI
Lecture 55 - Demonstration - XXII
Lecture 56 - Case Studies - I
Lecture 57 - Case Studies - II
Lecture 58 - Case Studies - III
Lecture 59 - Case Studies - IV
Lecture 60 - Case Studies - V
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NPTEL Video Course - Computer Science and Engineering - NOC:Discrete Structures

Subject Co-ordinator - Prof. Dipanwita Roychowdhury

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to Propositional Logic
Lecture 2 - Introduction to Propositional Logic (Continued...)
Lecture 3 - Introduction to Propositional Logic (Continued...)
Lecture 4 - Introduction to Propositional Logic (Continued...)
Lecture 5 - Introduction to Propositional Logic (Continued...)
Lecture 6 - Introduction to Propositional Logic (Continued...)
Lecture 7 - Predicate Logic
Lecture 8 - Predicate Logic (Continued...)
Lecture 9 - Predicate Logic (Continued...)
Lecture 10 - Predicate Logic (Continued...)
Lecture 11 - Proof Techniques
Lecture 12 - Proof Techniques (Continued...)
Lecture 13 - Proof Techniques (Continued...)
Lecture 14 - Proof Techniques (Continued...)
Lecture 15 - Proof Techniques (Continued...)
Lecture 16 - Sets and Functions
Lecture 17 - Sets and Functions (Continued...)
Lecture 18 - Sets and Functions (Continued...)
Lecture 19 - Sets and Functions (Continued...)
Lecture 20 - Sets and Functions (Continued...)
Lecture 21 - Relations and their Properties
Lecture 22 - Relations and their Properties (Continued...)
Lecture 23 - Relations and their Properties (Continued...)
Lecture 24 - Relations and their Properties (Continued...)
Lecture 25 - Relations and their Properties (Continued...)
Lecture 26 - Recursion
Lecture 27 - Recursion (Continued...)
Lecture 28 - Recursion (Continued...)
Lecture 29 - Recursion (Continued...)

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Lecture 30 - Recursion (Continued...)
Lecture 31 - Recurrence relations
Lecture 32 - Recurrence relations (Continued...)
Lecture 33 - Recurrence relations (Continued...)
Lecture 34 - Recurrence relations (Continued...)
Lecture 35 - Recurrence relations (Continued...)
Lecture 36 - Counting Techniques and Pigeonhole Principle
Lecture 37 - Counting Techniques and Pigeonhole Principle (Continued...)
Lecture 38 - Counting Techniques and Pigeonhole Principle (Continued...)
Lecture 39 - Counting Techniques and Pigeonhole Principle (Continued...)
Lecture 40 - Counting Techniques and Pigeonhole Principle (Continued...)
Lecture 41 - Combinatorics
Lecture 42 - Combinatorics (Continued...)
Lecture 43 - Combinatorics (Continued...)
Lecture 44 - Combinatorics (Continued...)
Lecture 45 - Combinatorics (Continued...)
Lecture 46 - Algebraic Structures
Lecture 47 - Algebraic Structures (Continued...)
Lecture 48 - Algebraic Structures (Continued...)
Lecture 49 - Algebraic Structures (Continued...)
Lecture 50 - Algebraic Structures (Continued...)
Lecture 51 - Ring and Modular Arithmetic
Lecture 52 - Ring and Modular Arithmetic (Continued...)
Lecture 53 - Ring and Modular Arithmetic (Continued...)
Lecture 54 - Ring and Modular Arithmetic (Continued...)
Lecture 55 - Ring and Modular Arithmetic (Continued...)
Lecture 56 - Finite Field and Applications
Lecture 57 - Finite Field and Applications (Continued...)
Lecture 58 - Finite Field and Applications (Continued...)
Lecture 59 - Finite Field and Applications (Continued...)
Lecture 60 - Finite Field and Applications (Continued...)
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NPTEL Video Course - Computer Science and Engineering - NOC:Embedded System Design with ARM

Subject Co-ordinator - Prof. Indranil Sengupta, Prof. Kamalika Datta

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction To Embedded Systems
Lecture 2 - Design Considerations of Embedded Systems
Lecture 3 - Microprocessors and Microcontrollers
Lecture 4 - Architecture of ARM Microcontroller - Part 1
Lecture 5 - Architecture of ARM Microcontroller - Part 2
Lecture 6 - Architecture of ARM Microcontroller - Part 3
Lecture 7 - ARM Instruction Set - Part 1
Lecture 8 - ARM Instruction Set - Part 2
Lecture 9 - ARM Instruction Set - Part 3
Lecture 10 - About the STM32F401 Nucleo Board
Lecture 11 - PWM and Interrupt on STM32F401
Lecture 12 - Digital to Analog Conversion
Lecture 13 - Analog to Digital Conversion - Part 1
Lecture 14 - Analog to Digital Conversion - Part 2
Lecture 15 - Output Devices, Sensors and Actuators - Part 1
Lecture 16 - Output Devices, Sensors and Actuators - Part 2
Lecture 17 - Output Devices, Sensors and Actuators - Part 3
Lecture 18 - Microcontroller Development Boards
Lecture 19 - Mbed C Programming Environment
Lecture 20 - Interfacing With STM32F401 Board
Lecture 21 - Interfacing With Arduino Uno
Lecture 22 - Interfacing 7-Segment Led And LCD Displays - Part 1
Lecture 23 - Interfacing 7-segment LED and LCD Displays - Part 2
Lecture 24 - Serial Port Terminal Application (Coolterm)
Lecture 25 - Experiment With Temperature Sensor
Lecture 26 - Experiment With Ldr Light Sensor - Part 1
Lecture 27 - Experiment With Ldr Light Sensor - Part 2
Lecture 28 - Experiment With Speaker
Lecture 29 - Experiment With Microphone

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Lecture 30 - Design Of Control System
Lecture 31 - Experiments With Relay
Lecture 32 - Experiments On Speed Control Of Dc Motor
Lecture 33 - Experiment With Multiple Sensors And Relay
Lecture 34 - Introduction To Internet Of Things
Lecture 35 - Gsm And Bluetooth
Lecture 36 - Design Of A Home Automation System
Lecture 37 - Design Of A Simple Alarm System Using Touch Sensor
Lecture 38 - Accelerometer
Lecture 39 - Experiment Using Accelerometer
Lecture 40 - Experiment Using Bluetooth
Lecture 41 - Experiment With Gas Sensor
Lecture 42 - Summarization Of The Course
```

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NPTEL Video Course - Computer Science and Engineering - NOC:Hardware Security

Subject Co-ordinator - Dr. Debdeep Mukhopadhyay

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to Hardware Security - Part 1
Lecture 2 - Introduction to Hardware Security - Part 2
Lecture 3 - Algorithm to Hardware
Lecture 4 - Finite Field Architectures - 1
Lecture 5 - Finite Field Architectures - 1 (Continued...)
Lecture 6 - Hardware Design for Finite Field Inverse
Lecture 7 - Hardware Architecture for Finite Field Inverse
Lecture 8 - Background on Cryptography, Cryptanalysis and Advanced Encryption Standard (AES)
Lecture 9 - Advanced Encryption Standard (AES) andSide Channel Analysis
Lecture 10 - Field Isomorphisms
Lecture 11 - Field Isomorphisms (Continued...)
Lecture 12 - Hardware Implementation of Advanced Encryption
Lecture 13 - Hardware Implementation of Advanced Encryption
Lecture 14 - Hardware Implementation of Advanced Encryption (Continued...)
Lecture 15 - Compact AES-Box
Lecture 16 - Compact AES S-Box - Part II
Lecture 17 - Compact AES S-Box in Normal Basis - Part I
Lecture 18 - Compact AES S-Box in Normal Basis - Part II
Lecture 19 - Hardware for Elliptic Curve Cryptography - Part I
Lecture 20 - Hardware for Elliptic Curve Cryptography - Part II
Lecture 21 - Hardware for Elliptic Curve Cryptography - Part III
Lecture 22 - Hardware for Elliptic Curve Cryptography - Part IV
Lecture 23 - Hardware for Elliptic Curve Cryptography - Part V
Lecture 24 - Introduction to Side Channel Analysis
Lecture 25 - Power Analysis - Part I
Lecture 26
Lecture 27
Lecture 28
Lecture 29

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Lecture 30
Lecture 31 - Power Analysis - Part VII
Lecture 32 - Power Analysis - Part VIII
Lecture 33 - Power Analysis - Part IX
Lecture 34 - Power Analysis - Part X
Lecture 35 - Power Analysis - Part XI
Lecture 36
Lecture 37
Lecture 38
Lecture 39
Lecture 40
Lecture 41 - Power Analysis - Part XVII
Lecture 42 - Power Analysis - Part XVIII
Lecture 43 - Power Analysis Countermeasures
Lecture 44 - Power Analysis Countermeasures (Continued...)
Lecture 45 - Power Analysis Countermeasures (Continued...)
Lecture 46 - Fault Analysis of Cryptosystems
Lecture 47 - Improved DFA of AES
Lecture 48 - Multi-Byte and key Scheduling Based Fault Analysis of AES
Lecture 49 - Multi-Byte and key Scheduling Based Fault Analysis of AES (Continued...)
Lecture 50 - Redundaney Based Fault Intensity
Lecture 51 - Reundancy Base Fault Countermeasures and Differential Faut Intensity Attacks (Continued...)
Lecture 52 - Infective Countermeasures for DFA
Lecture 53 - Infective Countermeasures for DFA (Continued...)
Lecture 54 - Infective Countermeasures for DFA (Continued...)
Lecture 55 - Microarchitectural attacks
Lecture 56 - Microarchitectural attacks
Lecture 57 - Microarchitectural attacks
Lecture 58 - Microarchitectural attacks
Lecture 59 - Microarchitectural attacks
Lecture 60 - Microarchitectural attacks
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NPTEL Video Course - Computer Science and Engineering - NOC:Introduction to Industry 4.0 and Industrial Inter

Subject Co-ordinator - Prof. Sudip Misra

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction
Lecture 2 - Introduction
Lecture 3 - Introduction
Lecture 4 - Introduction
Lecture 5 - Introduction
Lecture 6 - Industry 4.0
Lecture 7 - Industry 4.0
Lecture 8 - Industry 4.0
Lecture 9 - Industry 4.0
Lecture 10 - Industry 4.0
Lecture 11 - Industry 4.0
Lecture 12 - Industry 4.0
Lecture 13 - Industry 4.0
Lecture 14 - Industry 4.0
Lecture 15 - Industry 4.0
Lecture 16 - Industry 4.0
Lecture 17 - Basics of Industrial IoT
Lecture 18 - Basics of Industrial IoT
Lecture 19 - Basics of IIoT
Lecture 20 - Basics of Industrial IoT
Lecture 21 - Basics of Industrial IoT
Lecture 22 - Business Models and Reference Architecture for IIoT
Lecture 23 - Business Models and Reference Architecture for IIoT
Lecture 24 - Business Models and Reference Architecture for IIoT
Lecture 25 - Business Models and Reference Architecture for IIoT
Lecture 26 - Key Enablers of Industrial IoT
Lecture 27 - Key Enablers of Industrial IoT
Lecture 28 - Key Enablers of Industrial IoT
Lecture 29 - Key Enablers of Industrial IoT

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Lecture 30 - Key Enablers of Industrial IoT
Lecture 31 - Key Enablers of Industrial IoT
Lecture 32 - Key Enablers of Industrial IoT
Lecture 33 - Key Enablers of Industrial IoT
Lecture 34 - Key Enablers of Industrial IoT
Lecture 35 - Key Enablers of Industrial IoT
Lecture 36 - IIoT Analytics and Data Management
Lecture 37 - IIoT Analytics and Data Management
Lecture 38 - IIoT Analytics and Data Management
Lecture 39 - IIoT Analytics and Data Management
Lecture 40 - IIoT Analytics and Data Management
Lecture 41 - Analytics and Data Management
Lecture 42 - IIoT Analytics and Data Management
Lecture 43 - IIoT Analytics and Data Management
Lecture 44 - IIoT Analytics and Data Management
Lecture 45 - Advanced Technologies
Lecture 46 - Advanced Technologies
Lecture 47 - Advanced Technologies
Lecture 48 - Advanced Technologies
Lecture 49 - IIoT Applications
Lecture 50 - IIoT Applications
Lecture 51 - IIoT Applications
Lecture 52 - IIoT Applications
Lecture 53 - IIoT Applications
Lecture 54 - IIoT Applications
Lecture 55 - IIoT Applications
Lecture 56 - IIoT Applications
Lecture 57 - IIoT Applications
Lecture 58 - Case Studies for Industry 4.0 and IIoT
Lecture 59 - Milk Processing and Packaging Industries
Lecture 60 - Manufacturing Industries - Part I
Lecture 61 - Manufacturing Industries - Part II
Lecture 62 - Student Projects - Part I
Lecture 63 - Student Projects - Part II
Lecture 64 - Virtual Reality Lab
Lecture 65 - Steel Technology Lab
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NPTEL Video Course - Computer Science and Engineering - NOC:Introduction to Automata, Languages and Computati

Subject Co-ordinator - Prof. Sourav Mukhopadhyay

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Deterministic Finite Automata (DFA)
Lecture 2 - Input alphabet
Lecture 3 - Extended transition function
Lecture 4 - Language of DFA
Lecture 5 - Building DFA
Lecture 6 - Building DFA (Continued...)
Lecture 7 - NFA (Nondeterministic Finite Automata)
Lecture 8 - Language of a NFA
Lecture 9 - Equivalence of DFAs and NFAs
Lecture 10 - Subset Construction
Lecture 11 - Ã•Âµ-NFA
Lecture 12 - Extended transition function of NFA
Lecture 13 - Language of NFA
Lecture 14 - NFA to NFA
Lecture 15 - NFA to DFA
Lecture 16 - Regular expression
Lecture 17 - Regular expression (Continued...)
Lecture 18 - More on regular expression
Lecture 19 - Equivalence of NFA and regular expression
Lecture 20 - Equivalence of NFA and regular expression (Continued...)
Lecture 21 - DFA to Regular expression
Lecture 22 - DFA to Regular expression (Continued...)
Lecture 23 - Construction of regular expression from a DFA (example)
Lecture 24 - Closure properties of Regular Set
Lecture 25 - Closure properties of Regular Set (Continued...)
Lecture 26 - Substitution
Lecture 27 - Pumping Lemma
Lecture 28 - Application of the pumping lemma
Lecture 29 - More on Pumping lemma

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Lecture 30 - Ardens Theorem
Lecture 31 - Minimization of FA
Lecture 32 - Minimization of FA (Continued...)
Lecture 33 - Two way FA
Lecture 34 - Finite automata with output
Lecture 35 - Equivalence of Moore and Mealy machine
Lecture 36 - Context free grammars (CFG)
Lecture 37 - Context free language (CFL)
Lecture 38 - More example on CFL
Lecture 39 - More on CFG
Lecture 40 - Derivation Tree/Parse Tree
Lecture 41 - Leftmost and Rightmost derivations
Lecture 42 - Ambiguity in CFG
Lecture 43 - Simplification of CFG
Lecture 44 - Algorithms to construct reduced grammar
Lecture 45 - Elimination of Null and Unit productions
Lecture 46 - Chomsky Normal Form (CNF)
Lecture 47 - Greibach Normal Form (GNF)
Lecture 48 - Pushdown Automata (PDA)
Lecture 49 - Language accepted by PDA
Lecture 50 - Example of a language accepted by PDA
Lecture 51 - Deterministic PDA
Lecture 52 - Equivalence of language accepted
Lecture 53 - Equivalence PDA
Lecture 54 - Equivalence PDA and CFL
Lecture 55 - Equivalence PDA and CFL (Continued...)
Lecture 56 - Relationship between regular language and CFL
Lecture 57 - Pumping lemma for CFLs
Lecture 58 - Closer properties of CFLs
Lecture 59 - Turning Machine
Lecture 60 - Language accepted by a Turning machine
```

NPTEL Video Course - Computer Science and Engineering - NOC:Operating System Fundamentals

Subject Co-ordinator - Prof. Santanu Chattopadhyay

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable


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Lecture 1 - Introduction
Lecture 2 - Introduction (Continued...)
Lecture 3 - Introduction (Continued...)
Lecture 4 - Introduction (Continued...)
Lecture 5 - Introduction (Continued...)
Lecture 6 - Introduction (Continued...)
Lecture 7 - Operating System Structures
Lecture 8 - Operating System Structures (Continued...)
Lecture 9 - Operating System Structures (Continued...)
Lecture 10 - Operating System Structures (Continued...)
Lecture 11 - Operating System Structures (Continued...)
Lecture 12 - Processes
Lecture 13 - Processes (Continued...)
Lecture 14 - Processes (Continued...)
Lecture 15 - Processes (Continued...)
Lecture 16 - Processes (Continued...)
Lecture 17 - Processes (Continued...)
Lecture 18 - Processes (Continued...)
Lecture 19 - Threads
Lecture 20 - Threads (Continued...)
Lecture 21 - Threads (Continued...)
Lecture 22 - Threads (Continued...)
Lecture 23 - Threads, Scheduling
Lecture 24 - Scheduling
Lecture 25 - Scheduling (Continued...)
Lecture 26 - Scheduling (Continued...)
Lecture 27 - Scheduling (Continued...)
Lecture 28 - Scheduling (Continued...)
Lecture 29 - Process Synchronization
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Lecture 30 - Process Synchronization (Continued...)
Lecture 31 - Process Synchronization (Continued...)
Lecture 32 - Process Synchronization (Continued...)
Lecture 33 - Process Synchronization (Continued...)
Lecture 34 - Process Synchronization (Continued...)
Lecture 35 - Synchronization Examples
Lecture 36 - Synchronization Examples, Deadlock
Lecture 37 - Deadlock
Lecture 38 - Deadlock (Continued...)
Lecture 39 - Deadlock (Continued...)
Lecture 40 - Deadlock (Continued...)
Lecture 41 - Memory Management
Lecture 42 - Memory Management (Continued...)
Lecture 43 - Memory Management (Continued...)
Lecture 44 - Memory Management (Continued...)
Lecture 45 - Memory Management (Continued...)
Lecture 46 - Memory Management (Continued...)
Lecture 47 - Memory Management (Continued...)
Lecture 48 - Memory Management (Continued...)
Lecture 49 - Virtual Memory
Lecture 50 - Virtual Memory (Continued...)
Lecture 51 - Virtual Memory (Continued...)
Lecture 52 - Virtual Memory (Continued...)
Lecture 53 - Virtual Memory (Continued...)
Lecture 54 - Virtual Memory (Continued...)
Lecture 55 - Virtual Memory (Continued...)
Lecture 56 - Virtual Memory (Continued...)
Lecture 57 - File System and Secondary Storage
Lecture 58 - File System and Secondary Storage (Continued...)
Lecture 59 - File System and Secondary Storage (Continued...)
Lecture 60 - File System and Secondary Storage (Continued...)
```

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NPTEL Video Course - Computer Science and Engineering - NOC:Deep Learning (Prof. P.K. Biswas)

Subject Co-ordinator - Prof. P.K. Biswas

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction
Lecture 2 - Feature Descriptor - I
Lecture 3 - Feature Descriptor - II
Lecture 4 - Bayesian Learning - I
Lecture 5 - Bayesian Learning - II
Lecture 6 - Discriminant Function - I
Lecture 7 - Discriminant Function - II
Lecture 8 - Discriminant Function - III
Lecture 9 - Linear Classifier - I
Lecture 10 - Linear Classifier - II
Lecture 11 - Support Vector Machine - I
Lecture 12 - Support Vector Machine - II
Lecture 13 - Linear Machine
Lecture 14 - Multiclass Support Vector Machine - I
Lecture 15 - Multiclass Support Vector Machine - II
Lecture 16 - Optimization
Lecture 17 - Optimization Techniques in Machine Learning
Lecture 18 - Nonlinear Functions
Lecture 19 - Introduction to Neural Network
Lecture 20 - Neural Network - II
Lecture 21 - Multilayer Perceptron - I
Lecture 22 - Multilayer Perceptron - II
Lecture 23 - Backpropagation Learning
Lecture 24 - Loss Function
Lecture 25 - Backpropagation Learning- Example - I
Lecture 26 - Backpropagation Learning- Example - II
Lecture 27 - Backpropagation Learning- Example - III
Lecture 28 - Autoencoder
Lecture 29 - Autoencoder Vs PCA - I

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Lecture 30 - Autoencoder Vs PCA - II
Lecture 31 - Autoencoder Training
Lecture 32 - Autoencoder Variants - I
Lecture 33 - Autoencoder Variants - II
Lecture 34 - Convolution
Lecture 35 - Cross Correlation
Lecture 36 - CNN Architecture
Lecture 37 - MLP versus CNN, Popular CNN Architecture
Lecture 38 - Popular CNN Architecture
Lecture 39 - Popular CNN Architecture
Lecture 40 - Vanishing and Exploding Gradient
Lecture 41 - GoogleNet
Lecture 42 - ResNet, Optimisers
Lecture 43 - Optimisers
Lecture 44 - Optimisers
Lecture 45 - Optimisers
Lecture 46 - Normalization
Lecture 47 - Batch Normalization - I
Lecture 48 - Batch Normalization - II
Lecture 49 - Layer, Instance, Group Normalization
Lecture 50 - Training Trick, Regularization,Early Stopping
Lecture 51 - Face Recognition
Lecture 52 - Deconvolution Layer
Lecture 53 - Semantic Segmentation - I
Lecture 54 - Semantic Segmentation - II
Lecture 55 - Semantic Segmentation - III
Lecture 56 - Image Denoising
Lecture 57 - Variational Autoencoder - I
Lecture 58 - Variational Autoencoder - II
Lecture 59 - Variational Autoencoder - III
Lecture 60 - Generative Adversarial Network
```

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NPTEL Video Course - Computer Science and Engineering - NOC:Computer Vision

Subject Co-ordinator - Prof. Jayanta Mukhopadhyay

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Fundamentals of Image Processing - Part I
Lecture 2 - Fundamentals of Imagr Processing - Part II
Lecture 3 - Image Transform - Part I
Lecture 4 - Image Transform - Part II
Lecture 5 - Projective Geometry - Part I
Lecture 6 - Projective Geometry - Part II
Lecture 7 - Projective Transformation
Lecture 8 - Homography
Lecture 9 - Homography
Lecture 10 - Homography
Lecture 11 - Camera Geometry - Part I
Lecture 12 - Camera Geometry - Part II
Lecture 13 - Camera Geometry - Part III
Lecture 14 - Camera Geometry - Part IV
Lecture 15 - Camera Geometry - Part V
Lecture 16 - Stereo Geometry - Part I
Lecture 17 - Stereo Geometry - Part II
Lecture 18 - Stereo Geometry - Part III
Lecture 19 - Stereo Geometry - Part IV
Lecture 20 - Stereo Geometry - Part V
Lecture 21 - Stereo Geometry - Part VI
Lecture 22 - Stereo Geometry - Part VII
Lecture 23 - Stereo Geometry - Part VIII
Lecture 24 - Feature Detection And Description - Part I
Lecture 25 - Feature Detection And Description - Part II
Lecture 26 - Feature Detection And Description - Part III
Lecture 27 - Feature Detection And Description - Part IV
Lecture 28 - Feature Detection And Description - Part V
Lecture 29 - Feature Matching And Model Fitting- Part I

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Lecture 30 - Feature Matching And Model Fitting- Part II
Lecture 31 - Feature Matching And Model Fitting- Part III
Lecture 32 - Feature Matching And Model Fitting- Part IV
Lecture 33 - Feature Matching And Model Fitting- Part V
Lecture 34 - Color Fundamentals And Processing-Part I
Lecture 35 - Color Fundamentals And Processing-Part II
Lecture 36 - Color Fundamentals And Processing-Part III
Lecture 37 - Color Fundamentals And Processing-Part IV
Lecture 38 - Color Fundamentals And Processing-Part V
Lecture 39 - Color Fundamentals And Processing-Part VI
Lecture 40 - Color Fundamentals And Processing-Part VII
Lecture 41 - Range Image Processing - Part I
Lecture 42 - Range Image Processing - Part II
Lecture 43 - Range Image Processing - Part III
Lecture 44 - Range Image Processing - Part IV
Lecture 45 - Range Image Processing - Part V
Lecture 46 - Clustering and Classification - Part I
Lecture 47 - Clustering and Classification - Part II
Lecture 48 - Clustering and Classification - Part III
Lecture 49 - Clustering and Classification - Part IV
Lecture 50 - Clustering and Classification - Part V
Lecture 51 - Dimensional Reduction And Sparse Representation - Part I
Lecture 52 - Dimensional Reduction And Sparse Representation - Part II
Lecture 53 - Dimensional Reduction And Sparse Representation - Part III
Lecture 54 - Dimensional Reduction And Sparse Representation - Part IV
Lecture 55 - Deep Neural Architecture And Applications - Part I
Lecture 56 - Deep Neural Architecture And Applications - Part II
Lecture 57 - Deep Neural Architecture And Applications - Part III
Lecture 58 - Deep Neural Architecture And Applications - Part IV
Lecture 59 - Deep Neural Architecture And Applications - Part V
Lecture 60 - Deep Neural Architecture And Applications - Part VI
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NPTEL Video Course - Computer Science and Engineering - NOC:Ethical Hacking

Subject Co-ordinator - Prof. Indranil Sengupta

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to Ethical Hacking
Lecture 2 - Basic Concepts of Networking - Part I
Lecture 3 - Basic Concepts of Networking - Part II
Lecture 4 - TCP/IP Protocol Stack - Part I
Lecture 5 - TCP/IP Protocol Stack - Part II
Lecture 6 - IP addressing and routing - Part I
Lecture 7 - IP addressing and routing - Part II
Lecture 8 - TCP and UDP - Part I
Lecture 9 - TCP and UDP - Part II
Lecture 10 - IP subnetting
Lecture 11 - Routing protocols - Part I
Lecture 12 - Routing protocols - Part II
Lecture 13 - Routing protocols - Part III
Lecture 14 - IP version 6
Lecture 15 - Routing examples
Lecture 16 - Demonstration - Part I
Lecture 17 - Demonstration - Part II
Lecture 18 - Demonstration - Part III
Lecture 19 - Nessus Installation
Lecture 20 - How to use nessus
Lecture 21 - Metasploit Exploiting System Software - I
Lecture 22 - Metasploit Exploiting System Software - II
Lecture 23 - Metasploit Exploiting System Software and Privilege
Lecture 24 - Metasploit Social Eng Attack
Lecture 25 - MITM (Man in The middle) Attack
Lecture 26 - Basic concepts of cryptography
Lecture 27 - Private-key cryptography - Part I
Lecture 28 - Private-key cryptography - Part II
Lecture 29 - Public-key cryptography - Part I

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Lecture 30 - Public-key cryptography - Part II
Lecture 31 - Cryptographic hash functions - Part I
Lecture 32 - Cryptographic hash functions - Part II
Lecture 33 - Digital signature and certificate
Lecture 34 - Applications - Part I
Lecture 35 - Applications - Part II
Lecture 36 - Steganography
Lecture 37 - Biometrics
Lecture 38 - Network Based Attacks - Part I
Lecture 39 - Network Based Attacks - Part II
Lecture 40 - DNS and Email Security
Lecture 41 - Password cracking
Lecture 42 - Phishing attack
Lecture 43 - Maloeware
Lecture 44 - Wifi hacking
Lecture 45 - Dos and DDos attack
Lecture 46 - Elements of Hardware Security
Lecture 47 - Side Channel Attacks - Part I
Lecture 48 - Side Channel Attacks - Part II
Lecture 49 - Physical Unclonable Function
Lecture 50 - Hardware Trojan
Lecture 51 - Web Application Vulnerability Scanning
Lecture 52 - SQL Injection Authentication Bypass - Part 1
Lecture 53 - SQL Injection Error Based - Part 2
Lecture 54 - SQL Injection Error Based from Web Application - Part 3
Lecture 55 - SQLMAP
Lecture 56 - Cross Site Scripting
Lecture 57 - File Upload Vulnerability
Lecture 58 - The NMAP Tool
Lecture 59 - The NMAP Tool
Lecture 60 - The NMAP Tool
Lecture 61 - Network Analysis using Wireshark
Lecture 62 - Summarization of the Course
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NPTEL Video Course - Computer Science and Engineering - NOC:Software Project Management

Subject Co-ordinator - Prof. Durga Prasad Mohapatra

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction - I
Lecture 2 - Introduction - II
Lecture 3 - Introduction - III
Lecture 4 - Project Management Standards
Lecture 5 - Life Cycle Models - I
Lecture 6 - Life Cycle Models - II
Lecture 7 - Life Cycle Models - III
Lecture 8 - Life Cycle Models - IV
Lecture 9 - Life Cycle Models - V
Lecture 10 - Life Cycle Models - VI
Lecture 11 - Project Evaluation and Programme Management
Lecture 12 - Project Evaluation and Programme Management (Continued...)
Lecture 13 - Project Evaluation and Programme Management (Continued...)
Lecture 14 - Project Evaluation and Programme Management (Continued...)
Lecture 15 - Project Evaluation and Programme Management (Continued...)
Lecture 16 - Project Estimation Techniques
Lecture 17 - Project Estimation Techniques (Continued...)
Lecture 18 - Project Estimation Techniques (Continued...)
Lecture 19 - Project Estimation Techniques (Continued...)
Lecture 20 - Project Estimation Techniques (Continued...)
Lecture 21 - Project Estimation Techniques (Continued...)
Lecture 22 - Project Estimation Techniques (Continued...)
Lecture 23 - Project Estimation Techniques (Continued...)
Lecture 24 - Project Estimation Techniques (Continued...)
Lecture 25 - Project Estimation Techniques (Continued...)
Lecture 26 - Project Scheduling
Lecture 27 - Project Scheduling Using PERT/CPM
Lecture 28 - Project Scheduling Using PERT/CPM (Continued...)
Lecture 29 - Computation of Project Characteristics Using PERT/CPM

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Lecture 30 - Computation of Project Characteristics Using PERT/CPM
Lecture 31 - PERT, Project Crashing
Lecture 32 - Team Management
Lecture 33 - Organization and Team Structure
Lecture 34 - Team Structure (Continued...) and Risk Management
Lecture 35 - Risk Management (Continued...) and Introduction to Software Quality
Lecture 36 - Resource Allocation
Lecture 37 - Resource Allocation (Continued...)
Lecture 38 - Resource Allocation (Continued...)
Lecture 39 - Project Monitoring and Control
Lecture 40 - Project Monitoring and Control (Continued...)
Lecture 41 - Project Monitoring and Control (Continued...)
Lecture 42 - Project Monitoring and Control (Continued...)
Lecture 43 - Project Monitoring and Control (Continued...)
Lecture 44 - Project Monitoring and Control (Continued...)
Lecture 45 - Project Monitoring and Control (Continued...)
Lecture 46 - Project Monitoring and Control (Continued...)
Lecture 47 - Project Monitoring and Control (Continued...)
Lecture 48 - Contract Management
Lecture 49 - Contract Management (Continued...)
Lecture 50 - Project Close Out
Lecture 51 - Software Quality Management
Lecture 52 - ISO 9000
Lecture 53 - ISO 9001, SEI CMM
Lecture 54 - SEI CMM (Continued...)
Lecture 55 - SEI CMM (Continued...)
Lecture 56 - Personal Software Process (PSP)
Lecture 57 - Software Reliability - I
Lecture 58 - Software Reliability - II
Lecture 59 - Software Reliability - III
Lecture 60 - Software Testing
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NPTEL Video Course - Computer Science and Engineering - NOC:Spatial Informatics

Subject Co-ordinator - Prof. Soumya Kanti Ghosh

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction
Lecture 2 - Spatial Data Models - 1
Lecture 3 - Spatial Data Models - 2
Lecture 4 - Spatial Data Models - 3
Lecture 5 - Spatial Data Models - 4
Lecture 6 - Spatial Web Services - 1
Lecture 7 - Spatial Web Services - 2
Lecture 8 - Spatial Web Services - 3
Lecture 9 - Spatial Web Services - 4
Lecture 10 - Spatial Web Services - Demo
Lecture 11 - Spatial Database
Lecture 12 - Spatial Query Processing / SQL - 1
Lecture 13 - Spatial Query Processing / SQL - 2
Lecture 14 - Spatial Query Processing / SQL - 3
Lecture 15 - Spatial Query Processing / SQL - 4
Lecture 16 - Spatial Query Demo Tutorial
Lecture 17 - Spatial Indexing - I
Lecture 18 - Spatial Indexing - II
Lecture 19 - Spatial Indexing - III
Lecture 20 - Spatial Indexing - IV
Lecture 21 - Spatial Networks - I
Lecture 22 - Spatial Networks - II
Lecture 23 - Spatial Networks - III
Lecture 24 - Spatial Networks - IV
Lecture 25 - Spatial Networks - V
Lecture 26 - Spatial Analysis - I
Lecture 27 - Spatial Analysis - II
Lecture 28 - Spatial Analysis - III
Lecture 29 - Spatial Analysis - IV

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Lecture 30 - Spatial Analysis - V
Lecture 31 - Remote Sensing and GIS - I
Lecture 32 - Remote Sensing and GIS - II
Lecture 33 - Remote Sensing and GIS - III
Lecture 34 - Remote Sensing and GIS - IIV
Lecture 35 - Remote Sensing and GIS - V
Lecture 36 - SDS / Spatial Cloud / GeoViz - I
Lecture 37 - SDS / Spatial Cloud / GeoViz - II
Lecture 38 - SDS / Spatial Cloud / GeoViz - III
Lecture 39 - SDS / Spatial Cloud / GeoViz - IV
Lecture 40 - SDS / Spatial Cloud / GeoViz - V
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NPTEL Video Course - Computer Science and Engineering - NOC:GPU Architectures and Programming

Subject Co-ordinator - Prof. Soumyajit Dey

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Review of basic COA w.r.t. performance
Lecture 2 - Review of basic COA w.r.t. performance
Lecture 3 - Review of basic COA w.r.t. performance
Lecture 4 - Review of basic COA w.r.t. performance
Lecture 5 - Intro to GPU architectures
Lecture 6 - Intro to GPU architectures
Lecture 7 - Intro to GPU architectures
Lecture 8 - Intro to GPU architectures
Lecture 9 - Intro to CUDA programming
Lecture 10 - Intro to CUDA programming (Continued...)
Lecture 11 - Intro to CUDA programming (Continued...)
Lecture 12 - Intro to CUDA programming (Continued...)
Lecture 13 - Multi-dimensional mapping of dataspace; Synchronization
Lecture 14 - Multi-dimensional mapping of dataspace; Synchronization (Continued...)
Lecture 15 - Multi-dimensional mapping of dataspace; Synchronization (Continued...)
Lecture 16 - Warp Scheduling and Divergence
Lecture 17 - Warp Scheduling and Divergence (Continued...)
Lecture 18 - Warp Scheduling and Divergence (Continued...)
Lecture 19 - Memory Access Coalescing
Lecture 20 - Memory Access Coalescing (Continued...)
Lecture 21 - Memory Access Coalescing (Continued...)
Lecture 22 - Memory Access Coalescing (Continued...)
Lecture 23 - Memory Access Coalescing (Continued...)
Lecture 24 - Memory Access Coalescing (Continued...)
Lecture 25 - Memory Access Coalescing (Continued...)
Lecture 26 - Memory Access Coalescing (Continued...)
Lecture 27 - Memory Access Coalescing (Continued...)
Lecture 28 - Optimizing Reduction Kernels
Lecture 29 - Optimizing Reduction Kernels (Continued...)

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Lecture 30 - Optimizing Reduction Kernels (Continued...)
Lecture 31 - Optimizing Reduction Kernels (Continued...)
Lecture 32 - Optimizing Reduction Kernels (Continued...)
Lecture 33 - Optimizing Reduction Kernels (Continued...)
Lecture 34 - Optimizing Reduction Kernels (Continued...)
Lecture 35 - Kernel Fusion, Thread and Block Coarsening
Lecture 36 - Kernel Fusion, Thread and Block Coarsening (Continued...)
Lecture 37 - Kernel Fusion, Thread and Block Coarsening (Continued...)
Lecture 38 - Kernel Fusion, Thread and Block Coarsening (Continued...)
Lecture 39 - Kernel Fusion, Thread and Block Coarsening (Continued...)
Lecture 40 - Kernel Fusion, Thread and Block Coarsening (Continued...)
Lecture 41 - OpenCL - Runtime System
Lecture 42 - OpenCL - Runtime System (Continued...)
Lecture 43 - OpenCL - Runtime System (Continued...)
Lecture 44 - OpenCL - Runtime System (Continued...)
Lecture 45 - OpenCL - Runtime System (Continued...)
Lecture 46 - OpenCL - Runtime System (Continued...)
Lecture 47 - OpenCL - Runtime System (Continued...)
Lecture 48 - OpenCL - Heterogeneous Computing
Lecture 49 - OpenCL - Heterogeneous Computing (Continued...)
Lecture 50 - OpenCL - Heterogeneous Computing (Continued...)
Lecture 51 - OpenCL - Heterogeneous Computing (Continued...)
Lecture 52 - OpenCL - Heterogeneous Computing (Continued...)
Lecture 53 - OpenCL - Heterogeneous Computing (Continued...)
Lecture 54 - Efficient Neural Network Training/Inferencing
Lecture 55 - Efficient Neural Network Training/Inferencing (Continued...)
Lecture 56 - Efficient Neural Network Training/Inferencing (Continued...)
Lecture 57 - Efficient Neural Network Training/Inferencing (Continued...)
Lecture 58 - Efficient Neural Network Training/Inferencing (Continued...)
Lecture 59 - Efficient Neural Network Training/Inferencing (Continued...)
Lecture 60 - Efficient Neural Network Training/Inferencing (Continued...)
Lecture 61 - Efficient Neural Network Training/Inferencing (Continued...)
Lecture 62 - Efficient Neural Network Training/Inferencing (Continued...)
Lecture 63 - Efficient Neural Network Training/Inferencing (Continued...)
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NPTEL Video Course - Computer Science and Engineering - NOC:Google Cloud Computing Foundation Course

Subject Co-ordinator - Prof. Soumya Kanti Ghosh

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to Cloud
Lecture 2 - Cloud Computing
Lecture 3 - Cloud vs Traditional Architecture
Lecture 4 - Iaas, PaaS and SaaS
Lecture 5 - Google Cloud Architecture
Lecture 6 - Cloud Computing Recap Quiz
Lecture 7 - Summary - Cloud Computing
Lecture 8 - Introduction - Start with a Solid Platform
Lecture 9 - The GCP Console
Lecture 10 - Understanding Projects
Lecture 11 - Billing in GCP
Lecture 12 - Install and Configure Cloud SDK
Lecture 13 - Use Cloud Shell
Lecture 14 - GCP APIs
Lecture 15 - Cloud Console Mobile App
Lecture 16 - Recap Quiz - Start with a Solid Foundation
Lecture 17 - Introduction
Lecture 18 - Compute Options in the Cloud
Lecture 19 - Exploring IaaS with Compute Engine
Lecture 20 - Configuring Elastic Apps with Autoscaling
Lecture 21 - Exploring PaaS with App Engine
Lecture 22 - Event Driven Programs with Cloud Functions
Lecture 23 - Containerizing and Orchestrating Apps with GKE
Lecture 24 - Summary
Lecture 25 - Introduction
Lecture 26 - Storage Options in the Cloud
Lecture 27 - Structured and Unstructured Storage in the Cloud
Lecture 28 - Unstructured Storage using Cloud Storage
Lecture 29 - SQL Managed Services

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Lecture 30 - Exploring Cloud SQL
Lecture 31 - Cloud Spanner as a Managed Service
Lecture 32 - NoSQL Managed Services Options
Lecture 33 - Cloud Datastore a NoSQL Document Store
Lecture 34 - Cloud Bigtable as a NoSQL Option
Lecture 35 - Summary
Lecture 36 - Introduction to API
Lecture 37 - The Purpose of APIs
Lecture 38 - Cloud Endpoints
Lecture 39 - Using Apigee
Lecture 40 - Managed Message Services
Lecture 41 - Cloud Pub/Sub
Lecture 42 - Recap Quiz - There's an API for that!
Lecture 43 - Introduction - Cloud Security
Lecture 44 - Introduction to security in the cloud
Lecture 45 - Understanding the shared security model
Lecture 46 - Explore encryption options
Lecture 47 - Understand authentication and authorization
Lecture 48 - Identify best practices for authorization
Lecture 49 - Recap Quiz - Security
Lecture 50 - Summary - Security
Lecture 51 - Introduction
Lecture 52 - Intro to Networking in the Cloud
Lecture 53 - Defining a Virtual Private Cloud
Lecture 54 - Public and Private IP Address Basics
Lecture 55 - Googles Network Architecture
Lecture 56 - Routes and Firewall Rules in the Cloud
Lecture 57 - Multiple VPC Networks
Lecture 58 - Building Hybrid Clouds
Lecture 59 - Different Options for Load Balancing
Lecture 60 - Recap Quiz
Lecture 61 - Summary
Lecture 62 - Introduction - Let Google keep an eye on things
Lecture 63 - Introduction to IaC
Lecture 64 - Cloud Deployment Manager
Lecture 65 - Monitoring and Managing Your Services, Apps, and Infra
Lecture 66 - Stackdriver
Lecture 67 - Recap Quiz - Let Google keep an eye on things
Lecture 68 - Summary - Let Google keep an eye on things
```

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Lecture 69 - Introduction - You have the data, but what are you doing with it?
Lecture 70 - Intro to Big Data Managed Services in the Cloud
Lecture 71 - Leverage Big Data Operations with Cloud Dataproc
Lecture 72 - Build ETL Pipelines using Cloud Dataflow
Lecture 73 - BigQuery Googles Enterprise Data Warehouse
Lecture 74 - Recap Quiz - You have the data, but what are you doing with it?
Lecture 75 - Summary - You have the data, but what are you doing with it?
Lecture 76 - Introduction
Lecture 77 - Introduction to ML
Lecture 78 - ML and GCP
Lecture 79 - Building Bespoke ML models
Lecture 80 - Cloud AutoML
Lecture 81 - Googles Pre-trained ML APIs
Lecture 82 - Recap Quiz
Lecture 83 - Summary
```

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NPTEL Video Course - Computer Science and Engineering - NOC:Object Oriented System Development using UML, Jav

Subject Co-ordinator - Prof. Rajib Mall

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction
Lecture 2 - Basic Concepts in UML
Lecture 3 - Introduction to Use case Modelling
Lecture 4 - Factoring Use Cases
Lecture 5 - Use Case Examples
Lecture 6 - Use Case Guidelines
Lecture 7 - Class Diagram
Lecture 8 - Class Relations
Lecture 9 - Binary and Unary Associations
Lecture 10 - Implementation of Association Relation in Java
Lecture 11 - Implementation of Association in General Case
Lecture 12 - Association Class and Ternary Association
Lecture 13 - Qualified Association
Lecture 14 - Aggregation and Composition
Lecture 15 - Dependency Relation
Lecture 16 - Class Diagram Exercises
Lecture 17 - Interfaces, Packages and Abstract Classes
Lecture 18 - Polymorphism
Lecture 19 - State Machine Diagrams
Lecture 20 - State Charts Overview
Lecture 21 - Features of State Machine Model
Lecture 22 - Example of State Machine Modelling
Lecture 23 - Encoding a State Machine - I
Lecture 24 - Encoding a State Machine - II
Lecture 25 - Interaction Diagrams
Lecture 26 - Sequence Diagram - I
Lecture 27 - Sequence Diagram - II
Lecture 28 - Activity Diagram
Lecture 29 - Introduction to OOAD

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Lecture 30 - OOAD - I
Lecture 31 - OOAD - II
Lecture 32 - Example Application of OOAD
Lecture 33 - CRD Cards
Lecture 34 - Open/Closed Principle
Lecture 35 - LSP, ISP Principles
Lecture 36 - DIP Principle
Lecture 37 - Introduction to Design Pattern
Lecture 38 - GRASP Pattern
Lecture 39 - Expert and Creator Pattern
Lecture 40 - Pure Fabrication, Law of Demeter
Lecture 41 - Introduction to GOF Patterns
Lecture 42 - Facade Pattern
Lecture 43 - Observer Pattern - I
Lecture 44 - Observer Pattern - II
Lecture 45 - Singleton Pattern - I
Lecture 46 - Singleton Pattern - II
Lecture 47 - State Pattern - I
Lecture 48 - State Pattern - II
Lecture 49 - Composite Pattern - I
Lecture 50 - Composite Pattern - II
Lecture 51 - Adapter Pattern - I
Lecture 52 - Adapter Pattern - II
Lecture 53 - Bridge Pattern - I
Lecture 54 - Bridge Pattern - II
Lecture 55 - Proxy Pattern - I
Lecture 56 - Proxy Pattern - II
Lecture 57 - Decorator Pattern - I
Lecture 58 - Decorator Pattern - II
Lecture 59 - Decorator Pattern - III
Lecture 60 - Iterator Pattern
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NPTEL Video Course - Computer Science and Engineering - NOC:Data Structure and Algorithms using Java

Subject Co-ordinator - Prof. Debasis Samanta

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction and Course Plan
Lecture 2 - Generic Methods
Lecture 3 - Basics of Generic Class
Lecture 4 - Parameterized Generic Class
Lecture 5 - Bounded Argument Generic Class
Lecture 6 - Basics of the Framework
Lecture 7 - Collection in JCF
Lecture 8 - Set of JCF
Lecture 9 - Map Framework
Lecture 10 - Java Legacy Classes
Lecture 11 - Array Data Structures
Lecture 12 - Programming for Arrays
Lecture 13 - Class ArrayList for Arrays
Lecture 14 - Arrays for Arrays
Lecture 15 - Vector Class for Arrays
Lecture 16 - Linked List Data Structure - Part I
Lecture 17 - Linked List Data Structure - Part II
Lecture 18 - Programming for Linked Lists - Part I
Lecture 19 - Programming for Linked Lists - Part II
Lecture 20 - Linked Lists Using JCF
Lecture 21 - Stack Data Structures
Lecture 22 - Programming for Stack
Lecture 23 - Stack Using JCF
Lecture 24 - Queue Data Structure
Lecture 25 - Programming for Queue
Lecture 26 - Queue Using JCF
Lecture 27 - Understanding Tree Data Structures
Lecture 28 - Operations on Binary Tree Data Structures
Lecture 29 - Binary Search Tree

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Lecture 30 - Programming for Binary Search Tree
Lecture 31 - Height Balanced Binary Search Tree
Lecture 32 - Heap Tree
Lecture 33 - Programming for Heap Tree
Lecture 34 - Huffman Tree
Lecture 35 - Graph Structures
Lecture 36 - Graph Algorithms
Lecture 37 - Map Framework in Java
Lecture 38 - Applications of Map - Part I
Lecture 39 - Applications of Map - Part II
Lecture 40 - Collection Set
Lecture 41 - Operations on Set Collection
Lecture 42 - Introduction to java.io
Lecture 43 - IO with Byte Streams
Lecture 44 - IO with Character Streams
Lecture 45 - File Input-Output
Lecture 46 - Random Access File
Lecture 47 - Linear Searching Algorithms
Lecture 48 - Non-linear Searching Algorithms
Lecture 49 - Programs for Searching
Lecture 50 - Sorting Algorithms - Part I
Lecture 51 - Improved Sorting Algorithms
Lecture 52 - Advanced Sorting Algorithms
Lecture 53 - Programs for Sorting - Part I
Lecture 54 - Programs for Sorting - Part II
Lecture 55 - Sorting Using JCF
Lecture 56 - String Class
Lecture 57 - Applications of String
Lecture 58 - StringBuffer Class
Lecture 59 - Miscellaneous Utilities
Lecture 60 - Java Cursors
```

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NPTEL Video Course - Computer Science and Engineering - NOC:Real-Time Systems

Subject Co-ordinator - Prof. Rajib Mall

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction
Lecture 2 - Introduction
Lecture 3 - Characteristics of a real-time embedded system
Lecture 4 - Characteristics of a real-time embedded system
Lecture 5 - Types of real-time tasks
Lecture 6 - Events in a Real-Time System
Lecture 7 - Types of time constraints
Lecture 8 - Basics of Real-Time Task scheduling
Lecture 9 - Clock-driven schedulers
Lecture 10 - Basics of Cyclic schedulers
Lecture 11 - Cyclic Scheduler
Lecture 12 - Frame size constraints
Lecture 13 - Frame size selection: Examples
Lecture 14 - Event-driven scheduling
Lecture 15 - EDF scheduler
Lecture 16 - Variants of EDF and Rate Monotonic Scheduling
Lecture 17 - Rate Monotonic Schedulability Analysis
Lecture 18 - Rate Monotonic Schedulability Analysis
Lecture 19 - Rate Monotonic Scheduling: Miscellaneous issues
Lecture 20 - RMS Generalizations
Lecture 21 - RMS Generalizations
Lecture 22 - Handling aperiodic and sporadic tasks in rate monotonic scheduling
Lecture 23 - Handling aperiodic and sporadic tasks in rate monotonic scheduling
Lecture 24 - Coping up with Insufficient number of priorities
Lecture 25 - Handling task jitter and precedence ordering
Lecture 26 - Resource Sharing Among Real-Time Tasks
Lecture 27 - Basic priority inheritance protocol (PIP)
Lecture 28 - Highest Locker Protocol (HLP)
Lecture 29 - Priority Ceiling Protocol (PCP)

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Lecture 30 - Working of Priority Ceiling Protocol
Lecture 31 - Analysis of Priority Ceiling Protocol
Lecture 32 - Introduction to Multiprocessor and Distributed Systems
Lecture 33 - Static Allocation of Tasks
Lecture 34 - Dynamic Allocation of Tasks
Lecture 35 - Centralized Clock Synchronization in Distributed RT Systems
Lecture 36 - Distributed Clock Synchronization in R-T Systems
Lecture 37 - A Few Basics in Real-Time Operating Systems
Lecture 38 - Time Services
Lecture 39 - Unix as a Real-Time Operating System
Lecture 40 - Unix as a Real-Time Operating System (Continued...)
Lecture 41 - Windows as RTOS
Lecture 42 - POSIX
Lecture 43 - Unix-Based Real-Time Operating Systems
Lecture 44 - A survey of some contemporary Real-Time Operating Systems
Lecture 45 - A survey of some contemporary Real-Time Operating Systems (Continued...)
Lecture 46 - Benchmarking Real-Time Systems
Lecture 47 - Introduction to Real-Time Communication
Lecture 48 - Basics of Real-Time Communication
Lecture 49 - Basics of Networking
Lecture 50 - Basics of Internet
Lecture 51 - Real-Time Communication in a LAN
Lecture 52 - Bounded Access Protocols for LANs
Lecture 53 - Performance Comparison and QoS Framework
Lecture 54 - Routing and Resource Reservation
Lecture 55 - Rate Control
Lecture 56 - QoS Models and Soft Real-Time Communication in a LAN
Lecture 57 - Review of Basic Database Concepts
Lecture 58 - Applications and Issues of Real-Time Database
Lecture 59 - Characteristics of Temporal Data
Lecture 60 - Locking-Based Concurrency Control In Real-Time Databases
Lecture 61 - Concurrency Control In Real-Time Databases and Commercial RT Databases
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NPTEL Video Course - Computer Science and Engineering - NOC:Algorithms for Protein Modelling and Engineering

Subject Co-ordinator - Prof. Pralay Mitra

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction on Proteins
Lecture 2 - Introduction on Proteins (Continued...) and Sequence Database
Lecture 3 - Protein Data Bank
Lecture 4 - PDB Parsing
Lecture 5 - Molecular Visualization Tools
Lecture 6 - Representation and Data Structure
Lecture 7 - Digitization of a Molecule
Lecture 8 - Application to Protein Docking, FFT
Lecture 9 - Implementation Details
Lecture 10 - Hashing
Lecture 11 - Geometric Hashing
Lecture 12 - Geometric Hashing (Continued...)
Lecture 13 - Geometric Hashing (Continued...)
Lecture 14 - Molecular Surface
Lecture 15 - Genetic Algorithm (GA) for Surface Comparison
Lecture 16 - Monte Carlo (MC) Method
Lecture 17 - Monte Carlo Method (Continued...) and Random Number
Lecture 18 - Monte Carlo (MC) Method (Continued...)
Lecture 19 - Protein Folding
Lecture 20 - Protein Folding (Continued...) and Protein Design
Lecture 21 - Protein Energy Landscape
Lecture 22 - Protein Energy Landscape (Continued...), Limitation of MC
Lecture 23 - Replica Exchange Monte Carlo (REMC)
Lecture 24 - Ab Initio Protein Folding
Lecture 25 - Structure Alignment Measures
Lecture 26 - Dynamic Programming
Lecture 27 - Dynamic Programming (Continued...), Sequence Alignment
Lecture 28 - Dynamic Programming (Continued...), Position Specific Scoring Matrix (PSSM)
Lecture 29 - Structure Alignment

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Lecture 30 - Structure Alignment (Continued...)
Lecture 31 - Structural Classification of Proteins (SCOP)
Lecture 32 - SCOP (Continued...), Symmetry in Proteins
Lecture 33 - Symmetry in Proteins
Lecture 34 - Discriminating Biological Protein Interfaces from Crystal Artifacts
Lecture 35 - Discriminating Biological Protein Interfaces from Crystal Artifacts (Continued...)
Lecture 36 - Discriminating Biological Protein Interfaces from Crystal Artifacts (Continued...)
Lecture 37 - Discriminating Biological Protein Interfaces from Crystal Artifacts (Continued...)
Lecture 38 - Symmetry-Based Protein Complex Modeling
Lecture 39 - Some Protein Docking Methods
Lecture 40 - Some Protein Docking Methods (Continued...)
Lecture 41 - Computational Protein Design (CPD)
Lecture 42 - Computational Protein Design (CPD) (Continued...)
Lecture 43 - Protein Design Energy Function
Lecture 44 - Protein Design Analysis
Lecture 45 - Application of Protein Design on Drug Design
Lecture 46 - RECM in Protein Design
Lecture 47 - Application of Protein Design on Drug Design
Lecture 48 - Application of Protein Design on Drug Design (Continued...), Protein Modification
Lecture 49 - Protein Modification (Continued...)
Lecture 50 - Protein Modification (Continued...)
Lecture 51 - Assigning Secondary Structure to Protein Sequence
Lecture 52 - Assigning Secondary Structure to Protein Sequence (Continued...)
Lecture 53 - Machine Learning to Predict the Secondary Structure from Amino Acid Sequences
Lecture 54 - Machine Learning to Predict the Secondary Structure from Amino Acid Sequences (Continued...)
Lecture 55 - Post Translational Modification
Lecture 56 - Predicting Protein Phosphorylation Sites
Lecture 57 - Predicting Protein Phosphorylation Sites (Continued...)
Lecture 58 - Summarizing Protein Folding and Protein Docking
Lecture 59 - Summarizing Protein Folding and Protein Docking (Continued...)
Lecture 60 - Summarizing Potein Engineering
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NPTEL Video Lecture Topic List - Created by LinuXpert Systems, Chennai
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NPTEL Video Course - Computer Science and Engineering - NOC:Programming in Modern C++

Subject Co-ordinator - Prof. Partha Pratim Das

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Course Outline
Lecture 2 - Quick Recap 01: Recap of C/1
Lecture 3 - Quick Recap 02: Recap of C/2
Lecture 4 - Course Overview
Lecture 5 - IO and Loop
Lecture 6 - Arrays and Strings
Lecture 7 - Sorting and Searching
Lecture 8 - Stack and Common Data Structures/Containers
Lecture 9 - Tutorial 1: How to build a C/C++ program?: Part 1: C Preprocessor (CPP)
Lecture 10 - Constants and Inline Functions
Lecture 11 - Reference and Pointer
Lecture 12 - Default Parameters and Function Overloading
Lecture 13 - Operator Overloading
Lecture 14 - Dynamic Memory Management
Lecture 15 - Tutorial 2: How to build a C/C++ program?: Part 2: Build Pipeline
Lecture 16 - Static Members
Lecture 17 - Classes and Objects
Lecture 18 - Access Specifiers
Lecture 19 - Constructors, Destructors and Object Lifetime
Lecture 20 - Copy Constructor and Copy Assignment Operator
Lecture 21 - Const-ness
Lecture 22 - Tutorial 3: How to build a C/C++ program?: Part 3: make Utility
Lecture 23 - Static Members
Lecture 24 - Friend Function and Friend Class
Lecture 25 - Overloading Operator for User-Defined Types: Part 1
Lecture 26 - Overloading Operator for User-Defined Types: Part 2
Lecture 27 - Namespace
Lecture 28 - Tutorial 4: How to build a C/C++ program?: Part 4: Static and Dynamic Library
Lecture 29 - Inheritance: Part 2 (Data Member and Member Function - Override and Overload)

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Lecture 30 - Inheritance: Part 3 (Constructor and Destructor - Object Lifetime)
Lecture 31 - Inheritance: Part 4: Phone Hierarchy
Lecture 32 - Inheritance: Part 5: private and protected Inheritance
Lecture 33 - Tutorial 5: Mixing C and C++ Code: Part 1: Issues and Resolutions
Lecture 34 - Polymorphism: Part 1: Type Casting
Lecture 35 - Polymorphism: Part 2: Static and Dynamic Binding
Lecture 36 - Polymorphism: Part 3: Abstract Base Class
Lecture 37 - Polymorphism: Part 4: Staff Salary Processing using C
Lecture 38 - Polymorphism: Part 5: Staff Salary Processing using C++
Lecture 39 - Tutorial 6: Mixing C and C++ Code: Part 2: Project Example
Lecture 40 - Virtual Function Table
Lecture 41 - Type Casting and Cast Operators: Part 1
Lecture 42 - Type Casting and Cast Operators: Part 2
Lecture 43 - Type Casting and Cast Operators: Part 3
Lecture 44 - Multiple Inheritance
Lecture 45 - Tutorial 7: How to design a UDT like built-in types?: Part 1: Fraction UDT
Lecture 46 - Exceptions (Error handling in C): Part 1
Lecture 47 - Exceptions (Error handling in C++): Part 2
Lecture 48 - Template (Function Template): Part 1
Lecture 49 - Template (Class Template): Part 2
Lecture 50 - Functors: Function Objects
Lecture 51 - Tutorial 8: How to design a UDT like built-in types?: Part 2: Int and Poly UDT
Lecture 52 - Input-Output: File Handling in C
Lecture 53 - Input-Output: Streams in C++
Lecture 54 - C++ Standard Library: Part 1 (Generic Programming)
Lecture 55 - C++ Standard Library: Part 2 (STL)
Lecture 56 - C++ Standard Library: Part 3 (STL)
Lecture 57 - Tutorial 9: How to design a UDT like built-in types?: Part 3: Updates and Mixes of UDTs
Lecture 58 - C++11 and beyond: General Features: Part 1
Lecture 59 - C++11 and beyond: General Features: Part 2
Lecture 60 - C++11 and beyond: General Features: Part 3
Lecture 61 - C++11 and beyond: General Features: Part 4: Rvalue and Move/1
Lecture 62 - C++11 and beyond: General Features: Part 5: Rvalue and Move/2
Lecture 63 - Tutorial 10: How to optimize C++11 programs using Rvalue and Move Semantics?
Lecture 64 - C++11 and beyond: General Features: Part 6: Rvalue and Perfect Forwarding
Lecture 65 - C++11 and beyond: General Features: Part 7: Lambda in C++/1
Lecture 66 - C++11 and beyond: General Features: Part 8: Lambda in C++/2
Lecture 67 - C++11 and beyond: Class Features
Lecture 68 - C++11 and beyond: Non-class Types and Template Features
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Lecture 69 - Tutorial 11: Compatibility of C and C++: Part 1: Significant Features
Lecture 70 - C++11 and beyond: Resource Management by Smart Pointers: Part 1
Lecture 71 - C++11 and beyond: Resource Management by Smart Pointers: Part 2
Lecture 72 - C++11 and beyond: Concurrency: Part 1
Lecture 73 - C++11 and beyond: Concurrency: Part 2
Lecture 74 - Closing Comments
Lecture 75 - Tutorial 12: Compatibility of C and C++: Part 2: Summary

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NPTEL Video Course - Computer Science and Engineering - NOC:Blockchain and its Applications

Subject Co-ordinator - Prof. Sandip Chakraborty, Prof. Shamik Sural

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - The Model of Decentralization
Lecture 2 - What is Blockchain
Lecture 3 - Basic Cryptographic Primitives - I
Lecture 4 - Basic Cryptographic Primitives - II
Lecture 5 - Basic Cryptographic Primitives - III
Lecture 6 - Basic Cryptographic Primitives - IV
Lecture 7 - Basic Cryptographic Primitives - V
Lecture 8 - Distributed Systems for Decentralization - The Beginningâ
Lecture 9 - The Evolution of Cryptocurrencies
Lecture 10 - Open Consensus and Bitcoin
Lecture 11 - Bitcoin Mining and Beyond
Lecture 12 - Smart Contracts and the Permissioned Models of Blockchainâ
Lecture 13 - Blockchain Elements - I
Lecture 14 - Blockchain Elements - II
Lecture 15 - Blockchain Elements - III
Lecture 16 - Blockchain Elements - IV
Lecture 17 - Blockchain Elements - V
Lecture 18 - Permissionless Model and Open Consensus
Lecture 19 - Nakamoto Consensus (Proof of Work)
Lecture 20 - Limitations of PoW: Forking and Security
Lecture 21 - Beyond PoW
Lecture 22 - Ethereum 1
Lecture 23 - Ethereum 2
Lecture 24 - Ethereum 3
Lecture 25 - Ethereum 4
Lecture 26 - Consensus for Permissioned Models
Lecture 27 - State Machine Replication as Distributed Consensus
Lecture 28 - Paxos
Lecture 29 - Paxos - Safety and Liveness

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Lecture 30 - Byzantine Faults
Lecture 31 - Byzantine Agreement Protocols
Lecture 32 - Safety and Liveness of PBFT
Lecture 33 - Enterprise Blockchains
Lecture 34 - Hyperledger Fabric 1
Lecture 35 - Hyperledger Fabric 2
Lecture 36 - Hyperledger Fabric 3
Lecture 37 - Hyperledger Fabric 4
Lecture 38 - Consensus Scalability
Lecture 39 - Bitcoin-NG
Lecture 40 - Collective Signing (CoSi)
Lecture 41 - ByzCoin
Lecture 42 - Algorand
Lecture 43 - Identity Management - I
Lecture 44 - Identity Management - II
Lecture 45 - Identity Management - III
Lecture 46 - Blockchain Interoperability - I
Lecture 47 - Blockchain Interoperability - II
Lecture 48 - Blockchain Interoperability - III
Lecture 49 - Hyperledger Indy - I
Lecture 50 - Hyperledger Indy - II
Lecture 51 - Hyperledger Aries
Lecture 52 - Blockchain Security - I
Lecture 53 - Blockchain Security - II
Lecture 54 - Blockchain Security - III
Lecture 55 - Use Cases
Lecture 56 - A Potential Use Case From a Critics Perspective
Lecture 57 - Blockchain in Financial Services
Lecture 58 - Public Sector Use Cases
Lecture 59 - Blockchain for Decentralized Marketplace - Part 1
Lecture 60 - Blockchain for Decentralized Marketplace - Part 2
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NPTEL Video Course - Computer Science and Engineering - NOC:Algorithmic Game Theory

Subject Co-ordinator - Prof. Palash Dey

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction
Lecture 2 - Assumptions of Game Theory
Lecture 3 - Examples of Games
Lecture 4 - Equilibrium Concepts
Lecture 5 - Nash Equilibrium
Lecture 6 - Indifference Principle
Lecture 7 - Security of Players
Lecture 8 - Minmax Theorem
Lecture 9 - Implications of Minmax Theorem
Lecture 10 - MSNEs of Matrix Games
Lecture 11 - Iterative Eliminations of Dominated Strategies
Lecture 12 - Iterative Eliminations of Dominated Strategies (Continued...)
Lecture 13 - Braess's paradox
Lecture 14 - Yao's Lemma and its applications
Lecture 15 - Support Enumeration Algorithm
Lecture 16 - Succinct game
Lecture 17 - Potential Games
Lecture 18 - Best Response Dynamics
Lecture 19 - Fast Convergence of Best Response Dynamics
Lecture 20 - Computing Ã Âµ-PSNE for Network Congestion Games
Lecture 21 - PSNE for Congestion Games
Lecture 22 - PSNE for Symmetric Congestion Games
Lecture 23 - Functional NP
Lecture 24 - PPAD Class
Lecture 25 - Sperner's Lemma
Lecture 26 - Approximate MSNE Computation
Lecture 27 - Correlated Equilibrium
Lecture 28 - Coarse Correlated Equilibrium
Lecture 29 - External Regret Framework

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Lecture 30 - Multiplicative Weight Algorithm
Lecture 31 - Multiplicative Weight Algorithm (Continued....)
Lecture 32 - Swap Regret and Correlated Equilibrium
Lecture 33 - Swap Regret to External Regret Reduction
Lecture 34 - Braess's paradox and Pigou's Network
Lecture 35 - PoA of Selfish Routing Game
Lecture 36 - PoA of Selfish Load Balancing Game
Lecture 37 - Bayesian Game
Lecture 38 - BNE of First Price Auction
Lecture 39 - Extensive Form Game
Lecture 40 - Mechanism Design Introduction
Lecture 41 - Implementation of Social Choice Functions
Lecture 42 - Revelation Principle
Lecture 43 - Properties of Social Choice Function
Lecture 44 - Gibbard-Satterthwaite Theorem
Lecture 45 - Quasilinear Environment
Lecture 46 - Ex-Post Efficiency
Lecture 47 - VCG Mechanism
Lecture 48 - Example of VCG Mechanism
Lecture 49 - Weighted VCG
Lecture 50 - Affine Maximizer
Lecture 51 - Recap of Topics Discussed so Far
Lecture 52 - Single Parameter Domain
Lecture 53 - DSIC in Single Parameter Domain
Lecture 54 - Mayerson's Lemma
Lecture 55 - Sponsored Search Auction
Lecture 56 - Intermediate Domain
Lecture 57 - Algorithmic Mechanism Design
Lecture 58 - Stable Matching
Lecture 59 - Gale-Shapley Algorithm
Lecture 60 - Properties of Stable Matching
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NPTEL Video Course - Computer Science and Engineering - NOC:Machine Learning for Earth System Sciences

Subject Co-ordinator - Prof. Adway Mitra

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction
Lecture 2 - Basics of Spatio-Temporal Modeling
Lecture 3 - Geostatistical Equation for Spatio-Temporal Process
Lecture 4 - Gaussian Process Regression and Inverse Problems
Lecture 5 - Anomaly Event Detection
Lecture 6 - Extreme Events
Lecture 7 - Extreme Value Theory
Lecture 8 - Causality
Lecture 9 - Networks
Lecture 10 - Data Assimilation
Lecture 11 - Challenges and Opportunities for ML in ESS
Lecture 12 - Types of Machine Learning Problems in ESS
Lecture 13 - Convolutional Networks for Spatial Problems
Lecture 14 - Sequential Models for Temporal Problems
Lecture 15 - Probabilistic Models for Earth System Science
Lecture 16 - Identification of Indian Monsoon Predictors
Lecture 17 - Statistical Downscaling of Rainfall with Machine Learning
Lecture 18 - Detection of Anomaly and Extreme Events
Lecture 19 - Identifying Causal Relations from Time-Series - 1
Lecture 20 - Identifying Causal Relations from Time-Series - 2
Lecture 21 - Spatio-Temporal Modelling of Extremes
Lecture 22 - Hierarchical Bayesian Models for Spatio-Temporal Processes
Lecture 23 - Geostatistical modelling for mapping based on in-situ measurements
Lecture 24 - Nowcasting of Extreme Weather Events
Lecture 25 - Discovering Clustered Weather Patterns
Lecture 26 - Interpretable Machine Learning for Earth System Science
Lecture 27 - Object Detection in Satellite Imagery - 1
Lecture 28 - Object Detection in Satellite Imagery - 2
Lecture 29 - Image Fusion from Multiple Sources for Remote Sensing

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Lecture 30 - Image Segmentation for Remote Sensing
Lecture 31 - Satellite Imagery as a Proxy for Geophysical Measurements
Lecture 32 - Precipitation Nowcasting from Remote Sensing
Lecture 33 - Deep Domain Adaptation for Remote Sensing
Lecture 34 - Introduction to Earth System Modelling
Lecture 35 - Stochastic Weather Generator
Lecture 36 - Physics-Inspired Machine Learning for Process Models - 1
Lecture 37 - Physics-Inspired Machine Learning for Process Models - 2
Lecture 38 - Parameterizations for Sub-Grid Processes Using ML
Lecture 39 - Data Assimilation for Earth System Model Correction
Lecture 40 - ML for Climate Change Projection and Course Conclusion
```

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NPTEL Video Course - Computer Science and Engineering - NOC:Statistical Learning for Reliability Analysis

Subject Co-ordinator - Prof. Monalisa Sarma

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to Reliability Engineering
Lecture 2 - Introduction to Statistical Methods in Reliability
Lecture 3 - Concept of Probability and Probability Theory
Lecture 4 - Tutorial on Introduction to RE, SL and Probability Theory - Part I
Lecture 5 - Conditional, Total and Reverse Probability
Lecture 6 - Tutorial on Conditional Probability and Total Probability
Lecture 7 - Introduction to Probability Distributions
Lecture 8 - Introduction to Probability Distributions (Continued...)
Lecture 9 - Discrete Probability Distribution - Part 1
Lecture 10 - Discrete Probability Distribution - Part 2
Lecture 11 - Tutorial on Discrete Probability Distributions
Lecture 12 - Continuous Probability Distributions - Part 1
Lecture 13 - Continuous Probability Distributions - Part 2
Lecture 14 - Tutorial on Continuous Probability Distribution Functions - Part 1
Lecture 15 - Tutorial on Continuous Probability Distribution Functions - Part 2
Lecture 16 - Sampling Distributions - Part 1
Lecture 17 - Sampling Distributions - Part 2
Lecture 18 - Sampling Distributions - Part 3
Lecture 19 - Sampling Distributions - Part 4
Lecture 20 - Sampling Distributions - Part 5
Lecture 21 - Tutorial on Sampling Distributions
Lecture 22 - Statistical Inference - Part 1
Lecture 23 - Statistical Inference - Part 2
Lecture 24 - Statistical Inference - Part 3
Lecture 25 - Tutorial on Statistical Inference
Lecture 26 - Statistical Inference - Part 4
Lecture 27 - Statistical Inference - Part 5
Lecture 28 - Tutorial on Confidence Interval
Lecture 29 - Statistical Inference - Part 6

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Lecture 30 - Statistical Inference - Part 7
Lecture 31 - Statistical Inference - Part 8
Lecture 32 - ANOVA - I
Lecture 33 - ANOVA - II
Lecture 34 - ANOVA - III
Lecture 35 - ANOVA - IV
Lecture 36 - ANOVA - V
Lecture 37 - ANOVA - VI
Lecture 38 - Correlation Analysis - Part I
Lecture 39 - Correlation Analysis - Part II
Lecture 40 - Regression Analysis - Part I
Lecture 41 - Regression Analysis - Part II
Lecture 42 - Regression Analysis - Part III
Lecture 43 - Tutorial on Relation Analysis
Lecture 44 - Auto-Regression Analysis
Lecture 45 - Logistic Regression - Part I
Lecture 46 - Logistic Regression - Part II
Lecture 47 - Logistic Regression - Part III
Lecture 48 - Tutorial on Logistic Regression
Lecture 49 - Introduction
Lecture 50 - Bayesian Classification - Part I
Lecture 51 - Bayesian Classification - Part II
Lecture 52 - k-Nearest Neighbor Classification
Lecture 53 - Tutorial on Classification Techniques
Lecture 54 - Support Vector Machine - Part I
Lecture 55 - Support Vector Machine - Part II
Lecture 56 - Support Vector Machine - Part III
Lecture 57 - Support Vector Machine - Part IV
Lecture 58 - Support Vector Machine - Part V
Lecture 59 - Support Vector Machine - Part VI
Lecture 60 - Tutorial on SVM
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NPTEL Video Course - Computer Science and Engineering - NOC:Foundations of Cyber Physical Systems

Subject Co-ordinator - Prof. Soumyajit Dey

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - CPS: Motivational examples and compute platforms
Lecture 2 - CPS: Motivational examples and compute platforms (Continued...)
Lecture 3 - CPS: Motivational examples and compute platforms (Continued...)
Lecture 4 - CPS: Motivational examples and compute platforms (Continued...)
Lecture 5 - CPS: Motivational examples and compute platforms (Continued...)
Lecture 6 - Real time sensing and communication for CPS
Lecture 7 - Real time sensing and communication for CPS (Continued...)
Lecture 8 - Real time sensing and communication for CPS (Continued...)
Lecture 9 - Real time sensing and communication for CPS (Continued...)
Lecture 10 - Real time task scheduling for CPS
Lecture 11 - Real time task scheduling for CPS (Continued...)
Lecture 12 - Real time task scheduling for CPS (Continued...)
Lecture 13 - Real time task scheduling for CPS (Continued...)
Lecture 14 - Real time task scheduling for CPS (Continued...)
Lecture 15 - Real time task scheduling for CPS (Continued...)
Lecture 16 - Real time task scheduling for CPS (Continued...)
Lecture 17 - Real time task scheduling for CPS (Continued...)
Lecture 18 - Dynamical system modeling, stability, controller design
Lecture 19 - Dynamical system modeling, stability, controller design (Continued...)
Lecture 20 - Dynamical system modeling, stability, controller design (Continued...)
Lecture 21 - Dynamical system modeling, stability, controller design (Continued...)
Lecture 22 - Dynamical system modeling, stability, controller design (Continued...)
Lecture 23 - Dynamical system modeling, stability, controller design (Continued...)
Lecture 24 - Delay-aware Design; Platform effect on Stability/Performance
Lecture 25 - Delay-aware Design; Platform effect on Stability/Performance (Continued...)
Lecture 26 - Delay-aware Design; Platform effect on Stability/Performance (Continued...)
Lecture 27 - Delay-aware Design; Platform effect on Stability/Performance (Continued...) Corrigendum
Lecture 28 - Hybrid Automata based modelling of CPS
Lecture 29 - Hybrid Automata based modelling of CPS (Continued...)

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Lecture 30 - Hybrid Automata based modelling of CPS (Continued...)
Lecture 31 - Hybrid Automata based modelling of CPS (Continued...)
Lecture 32 - Hybrid Automata based modelling of CPS (Continued...)
Lecture 33 - Reachability analysis
Lecture 34 - Reachability analysis (Continued...)
Lecture 35 - Reachability analysis (Continued...)
Lecture 36 - Reachability analysis (Continued...)
Lecture 37 - Lyapunov Stability, Barrier Functions
Lecture 38 - Lyapunov Stability, Barrier Functions (Continued...)
Lecture 39 - Lyapunov Stability, Barrier Functions (Continued...)
Lecture 40 - Lyapunov Stability, Barrier Functions (Continued...)
Lecture 41 - Lyapunov Stability, Barrier Functions (Continued...)
Lecture 42 - Lyapunov Stability, Barrier Functions (Continued...)
Lecture 43 - Quadratic Program based safe Controller Design
Lecture 44 - Quadratic Program based safe Controller Design (Continued...)
Lecture 45 - Quadratic Program based safe Controller Design (Continued...)
Lecture 46 - Quadratic Program based safe Controller Design (Continued...)
Lecture 47 - Neural Network (NN) Based controllers in CPS
Lecture 48 - Neural Network (NN) Based controllers in CPS (Continued...)
Lecture 49 - Neural Network (NN) Based controllers in CPS (Continued...)
Lecture 50 - State Estimation using Kalman Filters (KF)
Lecture 51 - State Estimation using Kalman Filters (KF) (Continued...)
Lecture 52 - Attack Detection and Mitigation in CPS
Lecture 53 - Attack Detection and Mitigation in CPS (Continued...)
Lecture 54 - Attack Detection and Mitigation in CPS (Continued...)
Lecture 55 - Attack Detection and Mitigation in CPS (Continued...)
Lecture 56 - Attack Detection and Mitigation in CPS (Continued...)
Lecture 57 - Attack Detection and Mitigation in CPS (Continued...)
Lecture 58 - Attack Detection and Mitigation in CPS (Continued...)
Lecture 59 - Attack Detection and Mitigation in CPS (Continued...)
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NPTEL Video Course - Computer Science and Engineering - NOC:Selected Topics in Algorithms

Subject Co-ordinator - Prof. Palash Dey

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to Maximum Flow
Lecture 2 - Ford - Fulkerson Method
Lecture 3 - Edmond - Karp Algorithm
Lecture 4 - Edmond - Karp Algorithm (Continued...)
Lecture 5 - Flow Decomposition
Lecture 6 - Maximum Bipartite Matching, Fattest Augmenting Path
Lecture 7 - Karger's Algorithm
Lecture 8 - Augmenting Path
Lecture 9 - Edmonds Blossom Algorithm
Lecture 10 - Edmond - Karp Algorithm (Continued...)
Lecture 11 - Introduction to Randomized Algorithm
Lecture 12 - Polynomial Identity Testing
Lecture 13 - Perfect Bipartite Matching, Randomized Quicksort
Lecture 14 - Concentration Inequalities: Markov, Chebyshev, Chernoff
Lecture 15 - Proof of Chernoff Bound
Lecture 16 - Coupon Collector Problem
Lecture 17 - Balls and Bins
Lecture 18 - Balls and Bins (Continued...)
Lecture 19 - Two Point Sampling
Lecture 20 - Randomized Algorithm for 2 SAT
Lecture 21 - Markov Chain, Periodicity, Stationary Distribution
Lecture 22 - Mixing Time, Reversible Markov Chain
Lecture 23 - Metropolis Algorithm, Markov Chain on Independent Sets
Lecture 24 - Random Walk on Cycles
Lecture 25 - Shuffling Cards
Lecture 26 - Monte Carlo Method, Hitting Time, Cover Time
Lecture 27 - DNF Counting
Lecture 28 - DNF Counting (Continued...)
Lecture 29 - Counting Independent Sets of a Graph

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Lecture 30 - Counting Independent Sets of a Graph (Continued...)
Lecture 31 - Introduction of NP, co-NP, and P
Lecture 32 - Turing Reduction, Karp Reduction
Lecture 33 - NP - Completeness of 3SAT
Lecture 34 - NP - Completeness of Independent Set
Lecture 35 - NP - Completeness of vertex cover and clique
Lecture 36 - NP - Completeness of 3-coloring
Lecture 37 - NP - Completeness of Subset sum and Knapsack
Lecture 38 - NP - Completeness of set cover, Weak and Strong NP - completeness
Lecture 39 - Self Reduction
Lecture 40 - Randomized Approximation Algorithm
Lecture 41 - Derandomization
Lecture 42 - Travelling Salesman Problem
Lecture 43 - 2-Factor Approximation Algorithm for Metric TSP
Lecture 44 - 1.5-Factor Approximation Algorithm for Metric TSP
Lecture 45 - Approximation Algorithm for Set Cover
Lecture 46 - FPTAS for Knapsack
Lecture 47 - Introduction to Linear Program
Lecture 48 - Introduction to Linear Program (Continued...,)
Lecture 49 - Dual Fitting
Lecture 50 - Dual Fitting (Continued...)
Lecture 51 - Dual Fitting
Lecture 52 - Set Cover using LP rounding
Lecture 53 - Vertex Cover using reduction to set cover
Lecture 54 - Vertex Cover LP
Lecture 55 - Randomized Rounding
Lecture 56 - Primal Dual Scheme
Lecture 57 - Introduction to Parameterized Algorithm
Lecture 58 - Faster FPT Algorithm for Vertex Cover
Lecture 59 - Introduction to Kernelization
Lecture 60 - Linear Programming Based Kernels
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NPTEL Video Course - Computer Science and Engineering - NOC:Foundations and Applications of Machine Learning

Subject Co-ordinator - Prof. Adway Mitra

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - AI/ML à¦ à¦¾à¦°à¦ªà¦¾à¦¶à§ à¦° à¦¨à¦¾à¦¨à¦¾ à¦ à¦¦à¦¾à¦¹à¦°à¦£
Lecture 2 - AI/ML à¦•à¦° à¦ à¦ªà¦ à¦°à¦£
Lecture 3 - Supervised and Unsupervised Learning (à¦¤à¦¤à§•à¦¤à§•à¦¬à¦¾à¬à§à¦¾à¦¨à§ à¦ à¦¤à¦¤à§•à¦¤à§•à¦-
Lecture 4 - ML Model à¦ Algorithm/à²à§ à¦ à¦ à¦¾à¦° 04 : à¦•à¦®à¦•à¦² à¦®à¦¡à§ à¦² à¦ à¦ à§•à¦¯à¦¾à¦²à¦ à¦
Lecture 5 - AI/ML problem -à¦•à¦° à¦ à¦ à¦¨ /à¦•à¦ /à¦•à¦®à¦•à¦² à¦¸à¦®à¦¸à§•à¦¯à¦¾ - à¦•à¦° à¦ à¦¨
Lecture 6 - K-nearest-neighbor classification/regression/K-à¦¨à¦¿à¦ à¦ à¦¬à¦°à§•à¦¤à§ -à¦ªà§•à¦°à¦¤à¦¿à¬§ à¦
Lecture 7 - à¦¨à§ à¦ªà§•à¦£à§•à¦¯à§ à¦° à¦ªà¦°à¦¿à¦®à¦¾à¦ª : Accuracy, Precision, Recall, Confusion
Lecture 8 - Discriminative Feature Selection
Lecture 9 - Decision Tree Algorithm/à¦¸à¦¿à¦ à§•à¦§à¦¾à¦¨à§•à¦¤à¦²à¦¤à¦¿à¦ à¦¾
Lecture 10 - Classifier -à¦•à¦° à¦¸à¦®à¦•à§•à¦ à¦¿ à¦ Random Forests
Lecture 11 - Probability Theory à¦¿à¦«à§ à¦° Î-à¦ à¦
Lecture 12 - Bayesian à¦•à¦¬à¦ NaÃ¯ve Bayes Classifier
Lecture 13 - Linear Algebra à¦¿à¦«à§ à¦° Î-à¦ à¦ à¦¾
Lecture 14 - Linear Classifiers à¦•à¦¬à¦ Perceptron Algorithm
Lecture 15 - Multi-class Linear Classifier à¦•à¦¬à¦ Logistic Regression
Lecture 16 - Optimization à¦¿à¦«à§ à¦° Î-à¦ à¦ à¦¾
Lecture 17 - Linear (à¦¸à¦°à²) à¦ Regularized (à¦ªà¦¿à¦°à§ à¦¶à¦¾à¦¿à§à¦¤) Regression
Lecture 18 - Max-margin Linear Classification/à¦¸à§ à¦¬à¦¾Ð Î° à¦¬Õ•à¦¬à¦§à¦¾à§ à¦¨à¦° Î-Ï à¦£à§ à¦à¦¬à¦-à¦¾
Lecture 19 - à¦ à§ Î•Ï•à¦® Ñ¹à¦¾à§ à§•à¦¤Ï´/Basic Neural Networks
Lecture 20 - Neural Network à¦ à¦ à¦¨ à¦ Backpropagation
Lecture 21 - Overfitting and Underfitting
Lecture 22 - Boosting-à¦•à¦° à¦®à¦¾à¦§Õ•à§ à¦® à¦¸à¦®Î Ñ-à¦¬Ð´ à¦ à¦¨à§•à¦®à¦¾à¦¨
Lecture 23 - Data à¦° à¦®à¦¾Ï•à¦¾ (dimensionality) à¦¿à¦¨à§ Ï´à¦£
Lecture 24 - à²à§ à¦ à¦ à¦¾à¦° à§¨à§ªà¦ à¦¶à§•à¦°à§ à¦£à§ à¦£à§ à¦ à¬§ à¦¶à¦¿à¦·à§•à§ à§ à¦° à¦®à¦¾à¦¨à¦ à¦°
Lecture 25 - Supervised Learning à¦ à¦¿à¦-à¦¯à¦¾à¦¨
Lecture 26 - Hierarchical Clustering/à¦¸à§•à¦¤à¦°à¦-à¦¿à¦¤à§•à¦¤à¦¿à¦ à¦ à§ à¦·à§•à¦ à§ à¦ à¦°à¦£
Lecture 27 - K-means Clustering/ K-à¦ à§ à¦ à§ à¦·à§•à¦ à§ à¦ à¦°à¦£
Lecture 28 - Evaluation of Clustering/à¦ à§ à¦·à§•à¦ à§ à¦ à¦°à¦£à¦° à¦®à§ à¦²à§•à¦¯à¦¾à¦¨ à¦¨
Lecture 29 - Mean-shift à¦•à¦¬à¦ DB-Scan à¦ à§ à¦·à§•à¦ à§ à¦ à¦°à¦£

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Lecture 30 - Graph-based Clustering/à¦ à§ à¦·à§•à¦ à§ à¦ à¦ºà¦£
Lecture 31 - Time-series/à¦¸à¦®à§ à¦ à§•à¦ºà¦®à§ à¦º à¦¬à¦¿à¦¶à§•à¦²à§ à¦·à¦£
Lecture 32 - à¦¬à§•à¦¯à¦¤à¦¿à¦ à§•à¦ºà¦®à§  à¦ à¦¦à¦¾à¦¹à¦ºà¦£ à¦ à¦¿à¦¹à§•à¦¨à¦¿à¦¤à¦ à¦ºà¦£
Lecture 33 - Image/à¦ à¦¿à¦¤à§•à¦º à¦¬à¦¿à¦¶à§•à¦²à§ à¦·à¦£
Lecture 34 - Neural Features for Images
Lecture 35 - à¦²à¦¿à¦ à¦¿à¦¤ Data à¦  à¦-à¦¾à¦·à¦¾ à¦¬à¦¿à¦¶à§•à¦²à§ à¦·à¦£
Lecture 36 - Sequential Neural Models and Natural Language Processing
Lecture 37 - à¦¸à§ à¦·à§•à¦ à¦¿à¦®à§ à¦²à¦ /Generative Models, Reinforcement Learning
Lecture 38 - Transfer Learning and Domain Adaptation
Lecture 39 - à¦¨à§ à¦¤à¦¿, à¦¨à¦¿à¦ºà¦ªà¦ à¦ à§•à¦·à¦¤à¦¾ à¦  à¦¬à§ à¦§à¦ à¦®à§•à¦¯à¦¤à¦¾
Lecture 40 - Machine Learning for Climate Sciences
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NPTEL Video Course - Computer Science and Engineering - NOC:Artificial Intelligence for Economics

Subject Co-ordinator - Prof. Dripto Bakshi, Prof. Adway Mitra, Prof. Palash Dey

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Network Data - Some Stories !!
Lecture 2 - The Stable Matching Algorithm
Lecture 3 - Uncertainty in Financial Markets : Idea of Hedging
Lecture 4 - Uncertainty in Financial Markets : Idea of Hedging (Continued...)
Lecture 5 - Uncertainty in Financial Markets : Idea of Hedging (Continued...)
Lecture 6 - Unconstrained Optimization
Lecture 7 - Constrained Optimization
Lecture 8 - Heuristic Search Techniques
Lecture 9 - Multi-objective Heuristic Search and Game Trees
Lecture 10 - Clustering and Segmentation
Lecture 11 - Decision Tree and Random Forest
Lecture 12 - Linear Regression and Classifiers
Lecture 13 - Uncertainty Modeling
Lecture 14 - Neural Networks
Lecture 15 - Deep Learning for Time Series Forecasting
Lecture 16 - Causality in Time-Series
Lecture 17 - Interventional Causality and Attribution
Lecture 18 - Game Theory
Lecture 19 - Game Theory (Continued...)
Lecture 20 - Game Theory (Continued...) Games with Incomplete Information
Lecture 21 - Game Theory (Continued...) Games with Incomplete Information (Continued...)
Lecture 22 - Game Theory - Sequential Games
Lecture 23 - Game Theory - Rubenstein Bargaining
Lecture 24 - Network Economics
Lecture 25 - Network Economics (Continued...)
Lecture 26 - Introduction to Auction Theory
Lecture 27 - Second Price Auction
Lecture 28 - First Price Auction
Lecture 29 - Overview of Mechanism Design

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Lecture 30 - Groves Mechanism
Lecture 31 - VCG Mechanism
Lecture 32 - Single Parameter Domain and Myerson Lemma
Lecture 33 - Sponsored Search Auction
Lecture 34 - Single Peaked Domain and Median Voting
Lecture 35 - Dimensionality Reduction (Principal Component Analysis) â   The Math Prerequisites
Lecture 36 - Dimensionality Reduction (Principal Component Analysis) â   The Technique
Lecture 37 - Agent-based Modeling for Economics
Lecture 38 - Computer Vision for Economics
Lecture 39 - Text Mining and NLP for Economics
Lecture 40 - Bias, Fairness, Ethics and Interpretability in AI
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NPTEL Video Course - Computer Science and Engineering - NOC:Approximation Algorithm

Subject Co-ordinator - Prof. Palash Dey

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Overview of NP-completeness and How to Tackle It
Lecture 2 - Deterministic Rounding of Linear Program: An Approximation Algorithm for Weighted
Lecture 3 - Overview of LP Duality and Complementary Slackness
Lecture 4 - Dual Rounding: An Approximation Algorithm for Weighted Set Cover
Lecture 5 - Primal dual method for Weighted Set Cover
Lecture 6 - Greedy algorithm for Weighted Set Cover
Lecture 7 - Dual Fitting Analysis of Greedy Set Cover
Lecture 8 - Randomized Rounding Algorithm for Weighted Set Cover
Lecture 9 - Scheduling Jobs with Deadlines and Release Dates on a Single Machine
Lecture 10 - The k-Center Problem
Lecture 11 - Local Search Algorithm for Scheduling Jobs on Multiple Identical Machines
Lecture 12 - Greedy Algorithm for Scheduling Jobs on Multiple Identical Machines
Lecture 13 - Inapproximability of the Traveling Salesman problem
Lecture 14 - 2-Approximation Algorithm for Metric TSP
Lecture 15 - 1.5-Approximation Algorithm for Metric TSP
Lecture 16 - Edge Coloring
Lecture 17 - Pseudo Polynomial Time Algorithm for Knapsack
Lecture 18 - FPTAS for Knapsack
Lecture 19 - PTAS for Minimizing Makespan for Scheduling Jobs on Constant Number of Machines
Lecture 20 - PTAS for Minimizing Makespan for Scheduling Jobs on Parallel Identical Machines
Lecture 21 - PTAS for Minimizing Makespan for Scheduling Jobs on Parallel Identical Machines (Continued...)
Lecture 22 - An APTAS for Bin Packing
Lecture 23 - An APTAS for Bin Packing (Continued...)
Lecture 24 - 2 Factor Approximation Algorithm for Scheduling Unweighted Jobs on a Single Machine
Lecture 25 - 3 Factor Approximation Algorithm for Scheduling Weighted Jobs on a Single Machine
Lecture 26 - A Polynomial Time Separation Oracle for Scheduling Weighted Jobs on a Single Machine
Lecture 27 - 3 Factor Approximation Algorithm for Prize Collecting Steiner Tree
Lecture 28 - 3 Factor Approximation Algorithm for Prize Collecting Steiner Tree (Continued...)
Lecture 29 - A 4 Factor Approximation Algorithm for Uncapacitated Facility Location Problem

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    Lecture 30 - A 4 Factor Approximation Algorithm for Uncapacitated Facility Location Problem (Continued...)
    Lecture 31 - A 4 Factor Approximation Algorithm for Uncapacitated Facility Location Problem (Continued...)
    Lecture 32 - Randomized 1/2 Factor Approximation Algorithm for MAX-SAT and MAX-CUT
    Lecture 33 - Derandomization using Method of Conditional Expectation
    Lecture 34 - Flipping Biased Coin for Better Than .5 Approximation Algorithm for Max-SAT
    Lecture 35 - Randomized Rounding Based (1-1/e) Factor Approximation Algorithm for Max-SAT
    Lecture 36 - Best of Two Solutions for Max-SAT
    Lecture 37 - Nonlinear Rounding for Max-SAT
    Lecture 38 - Randomized Rounding for Prize Collecting Steiner Tree
    Lecture 39 - Randomized Rounding for Prize Collecting Steiner Tree (Continued...)
    Lecture 40 - Randomized Rounding for Uncapacitated Facility Location
    Lecture 41 - Chernoff Bound
    Lecture 42 - Chernoff Bound (Continued...)
    Lecture 43 - Integer Multicommodity Flow
    Lecture 44 - Primal-dual Algorithm for Minimum Weighted Feedback Vertex Set
    Lecture 45 - Primal-dual Algorithm for Minimum Weighted Feedback Vertex Set (Continued...)
    Lecture 46 - Primal-dual Algorithm for Minimum Weighted Feedback Vertex Set (Continued...)
    Lecture 47 - Primal-dual Algorithm for Steiner Forest
    Lecture 48 - Primal-dual Algorithm for Steiner Forest (Continued...)
    Lecture 49 - Primal-dual Algorithm for Steiner Forest (Continued...)
    Lecture 50 - 2-Approximation Algorithm for Multiway Cut
    Lecture 51 - 3/2-Approximation Algorithm for Multiway Cut
    Lecture 52 - 3/2-Approximation Algorithm for Multiway Cut (Continued...)
    Lecture 53 - Approximation Algorithm for Multicut
    Lecture 54 - Approximation Algorithm for Multicut (Continued...)
    Lecture 55 - Approximation Algorithm for Multicut (Continued...)
    Lecture 56 - Introduction to Semidefinite Program
    Lecture 57 - SDP Based Approximation Algorithm for Max Cut
    Lecture 58 - SDP Based Approximation Algorithm for Max Cut (Continued...)
    Lecture 59 - Inapproximability of Scheduling Jobs on Multiple Non-identical Machines
    Lecture 60 - Inapproximability of Edge Disjoint Path
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NPTEL Video Course - Computer Science and Engineering - Pattern Recognition

Subject Co-ordinator - Prof. Sukhendu Das, Prof. C.A. Murthy

Co-ordinating Institute - IIT - Madras | Indian Statistical Institute

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Principles of Pattern Recognition I (Introduction and Uses)
Lecture 2 - Principles of Pattern Recognition II (Mathematics)
Lecture 3 - Principles of Pattern Recognition III (Classification and Bayes Decision Rule)
Lecture 4 - Clustering vs. Classification
Lecture 5 - Relevant Basics of Linear Algebra, Vector Spaces
Lecture 6 - Eigen Value and Eigen Vectors
Lecture 7 - Vector Spaces
Lecture 8 - Rank of Matrix and SVD
Lecture 9 - Types of Errors
Lecture 10 - Examples of Bayes Decision Rule
Lecture 11 - Normal Distribution and Parameter Estimation
Lecture 12 - Training Set, Test Set
Lecture 13 - Standardization, Normalization, Clustering and Metric Space
Lecture 14 - Normal Distribution and Decision Boundaries I
Lecture 15 - Normal Distribution and Decision Boundaries II
Lecture 16 - Bayes Theorem
Lecture 17 - Linear Discriminant Function and Perceptron
Lecture 18 - Perceptron Learning and Decision Boundaries
Lecture 19 - Linear and Non-Linear Decision Boundaries
Lecture 20 - K-NN Classifier
Lecture 21 - Principal Component Analysis (PCA)
Lecture 22 - Fisherâ s LDA
Lecture 23 - Gaussian Mixture Model (GMM)
Lecture 24 - Assignments
Lecture 25 - Basics of Clustering, Similarity/Dissimilarity Measures, Clustering Criteria.
Lecture 26 - K-Means Algorithm and Hierarchical Clustering
Lecture 27 - K-Medoids and DBSCAN
Lecture 28 - Feature Selection
Lecture 29 - Feature Selection

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Lecture 30 - Feature Selection
Lecture 31 - Cauchy Schwartz Inequality
Lecture 32 - Feature Selection Criteria Function
Lecture 33 - Feature Selection Criteria Function
Lecture 34 - Principal Components
Lecture 35 - Comparison Between Performance of Classifiers
Lecture 36 - Basics of Statistics, Covariance, and their Properties
Lecture 37 - Data Condensation, Feature Clustering, Data Visualization
Lecture 38 - Probability Density Estimation
Lecture 39 - Visualization and Aggregation
Lecture 40 - Support Vector Machine (SVM)
Lecture 41 - FCM and Soft-Computing Techniques
Lecture 42 - Examples of Uses or Application of Pattern Recognition; And When to do clustering
Lecture 43 - Examples of Real-Life Dataset
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NPTEL Video Course - Computer Science and Engineering - Performance Evaluation of Computer Systems

Subject Co-ordinator - Prof. Krishna Moorthy Sivalingam

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to performance evaluation of computer systems
Lecture 2 - How to avoid common mistakes
Lecture 3 - Selection of techniques and metrics
Lecture 4 - Case study
Lecture 5 - Random Variables and probability distributions
Lecture 6 - Probability distributions - I
Lecture 7 - Probability distributions - II
Lecture 8 - Probability distributions - III
Lecture 9 - Stochastic process
Lecture 10 - Markov Chain
Lecture 11 - Slotted Aloha protocol model and discrete-time birth death process
Lecture 12 - Continuous time Markov chain and queuing theory - I
Lecture 13 - Queuing theory - I (Continued)
Lecture 14 - Queuing theory - II
Lecture 15 - Queuing theory - III
Lecture 16 - Queuing theory - IV
Lecture 17 - Queuing theory - V
Lecture 18 - Queuing theory - VI
Lecture 19 - Queuing networks - I
Lecture 20 - Queuing networks - II
Lecture 21 - Slotted Aloha Markov model
Lecture 22 - Simulations - I
Lecture 23 - Simulations - II
Lecture 24 - Simulations - III
Lecture 25 - Operational laws - I
Lecture 26 - Operational laws - II
Lecture 27 - Open and closed queuing networks
Lecture 28 - Approximate MVA
Lecture 29 - Convolution algorithm - I

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Lecture 30 - Convolution algorithm - II
Lecture 31 - Load-dependent service centers
Lecture 32 - Hierarchical decomposition
Lecture 33 - Balanced Job Bounds
Lecture 34 - Confidence interval for propotions and introduction to experimental design
Lecture 35 - 2k factorial design
Lecture 36 - 2k r factorial design and 2k-p fractional factorial design
Lecture 37 - Programming aspects of discrete-event simulations - I
Lecture 38 - Programming aspects of discrete-event simulations - II
Lecture 39 - Discrete-event simulations - III
Lecture 40 - PetriNets - I
Lecture 41 - PetriNets - II
Lecture 42 - PetriNets - III
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NPTEL Video Course - Computer Science and Engineering - Theory of Automata, Formal Languages and Computation

Subject Co-ordinator - Prof. Kamala Krithivasan

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Grammars and Natural Language Processing
Lecture 2 - Grammars and Languages Generated
Lecture 3 - Grammars and Languages Generated (Continued.)
Lecture 4 - Ambiguity in CFG
Lecture 5 - Simplication of CFG
Lecture 6 - Removal of Unit Productions, Chomsky Normal Form for CFG
Lecture 7 - Greibach Normal Form for CFG
Lecture 8 - Final State Automata
Lecture 9 - Non Deterministic FSA
Lecture 10 - Non Deterministic FSA (Continued.)
Lecture 11 - Non Deterministic FSA with E(Epsilon)- Moves
Lecture 12 - Equivalence Between FSA and Type 3 Grammars
Lecture 13 - Regular Expressions, Regular Expressions to NFSA
Lecture 14 - DFSA to Regular Expressions
Lecture 15 - Problems and Solutions - I
Lecture 16 - Pumping Lemmas for Regular Sets and CFL
Lecture 17 - MYHILL - Nerode Theorem
Lecture 18 - Minimization of DFSA
Lecture 19 - FSA with output Moore and Mealy Machines
Lecture 20 - Pushdown Automata
Lecture 21 - Pushdown Automata, Equivalence Between Acceptance by Empty Store and Acceptance by Final State
Lecture 22 - Pushdown Automata CFG to PDA
Lecture 23 - Pushdown Automata PDA to CFG
Lecture 24 - Problems and Solutions - II
Lecture 25 - Problems and Solutions - III
Lecture 26 - Turing Machines
Lecture 27 - Turing Machines (Continued.)
Lecture 28 - Turing Machine as Acceptor, Techniques for TM Construction
Lecture 29 - Generalized Versions of Turing Machines

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Lecture 30 - Turing Machine as a Generating Device
Lecture 31 - Recursive Sets, Recursively Innumerable Sets, Encoding of TM, Halting Problem
Lecture 32 - Problems and Instances, Universal TM, Decidability
Lecture 33 - RICE'S Theorem, Linear Bounded Automata, Properties of TM
Lecture 34 - POST'S Correspondence Problems
Lecture 35 - POST'S Correspondence Problems (Continued.), Time and Tape Complexity of TM
Lecture 36 - NP - Complete Problems, Cook's Theorem
Lecture 37 - NP - Complete Problems (Continued.)
Lecture 38 - Regulated Rewriting
Lecture 39 - L-Systems
Lecture 40 - Grammar Systems
Lecture 41 - DNA Computing
Lecture 42 - Membrane Computing
```

NPTEL Video Course - Computer Science and Engineering - Computer Graphics

Subject Co-ordinator - Prof. Sukhendu Das

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction
Lecture 2 - CRT Display Devices
Lecture 3 - CRT Display Devices (Continued...)
Lecture 4 - CRT Display Devices (Continued...)
Lecture 5 - CRT Display Devices (Continued...)
Lecture 6 - Transformations in 2D
Lecture 7 - Transformations in 2D (Continued...)
Lecture 8 - Three Dimensional Graphics
Lecture 9 - Three Dimensional Graphics (Continued...)
Lecture 10 - Three Dimensional Graphics (Continued...)
Lecture 11 - Projection Transformations And Viewing Pipeline
Lecture 12 - 3D Viewing - Projection Transformations And Viewing Pipeline
Lecture 13 - Scan Converting Lines, Circles And Ellipses
Lecture 14 - Scan Converting Lines, Circles And Ellipses (Continued...)
Lecture 15 - Scan Converting Lines, Circles And Ellipses (Continued...)
Lecture 16 - Scan Converting Lines, Circles And Ellipses (Continued...)
Lecture 17 - Scan Converting Lines, Circles And Ellipses (Continued...)
Lecture 18 - Polyfill- Scan Conversion Of A Polygon
Lecture 19 - Scan Conversion Of A Polygon (Continued...)
Lecture 20 - Clipping - Lines And Polygons
Lecture 21 - Clipping Lines And Polygons
Lecture 22 - Clipping Lines
Lecture 23 - Solid Modelling
Lecture 24 - Solid Modelling
Lecture 25 - Solid Modelling (Continued...)
Lecture 26 - Visible Surface Detection
Lecture 27 - Visible Surface Detection (Continued...)
Lecture 28 - Visible Surface Detection (Continued...)
Lecture 29 - Visible Surface Detection (Continued...)

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Lecture 30 - Visible Surface Detection (Continued...)
Lecture 31 - Visible Surface Detection (Continued...)
Lecture 32 - Visible Surface Detection (Continued...)
Lecture 33 - Illumination And Shading
Lecture 34 - Illumination And Shading (Continued...)
Lecture 35 - Illumination And Shading (Continued...)
Lecture 36 - Curve Representation
Lecture 37 - Curve Representation (Continued...)
Lecture 38 - Curves And Surface Representation
Lecture 39 - Graphics Programming Using Open GL
Lecture 40 - Graphics Programming Using Open GL (Continued...)
Lecture 41 - Advanced Topics
Lecture 42 - Digital Image Processing Image Compression-Jpeg-Enhancements
Lecture 43 - Digital Image Processing (Continued...)
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NPTEL Video Course - Computer Science and Engineering - Computer Organization

Subject Co-ordinator - Prof. S. Raman

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable │ MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction To Computing
Lecture 2 - Introduction To System
Lecture 3 - Introduction To System
Lecture 4 - Processor Activities
Lecture 5 - Processor As a State Machine
Lecture 6 - Data Path Architecture
Lecture 7 - Data Path Controller
Lecture 8 - State Machine Design
Lecture 9 - Controller Design
Lecture 10 - Controller Design (Contd)
Lecture 11 - Typical Micro Instructions
Lecture 12 - Addressing Modes
Lecture 13 - Problem Exercise
Lecture 14 - Problem Exercise
Lecture 15 - Introduction to memory system
Lecture 16 - CPU - Memory Interaction
Lecture 17 - Cache Organization
Lecture 18 - Cache Organization
Lecture 19 - Virtual Memory
Lecture 20 - Virtual Memory
Lecture 21 - Performance Calculation
Lecture 22 - Segmentation
Lecture 23 - Address Translation and Protection
Lecture 24 - Programmed I/O
Lecture 25 - Interrupt Driven I/O
Lecture 26 - DMA
Lecture 27 - Device Service Routines
Lecture 28 - Evolution Of I/O
Lecture 29 - I/O Devices

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Lecture 30 - I/O Devices - Contd
Lecture 31 - Buses
Lecture 32 - Buses Contd
Lecture 33 - Conclusion

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NPTEL Video Course - Computer Science and Engineering - Database Design

Subject Co-ordinator - Dr. S. Srikanth, Prof. D. Janaki Ram

Co-ordinating Institute - IIT - Madras | IIIT - Bangalore

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable


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Lecture 1 - Introduction to Database Management System
Lecture 2 - Conceptual Designs
Lecture 3 - Conceptual Designs
Lecture 4 - Relational Model
Lecture 5 - Relational Model
Lecture 6 - Structured Query Language - I
Lecture 7 - Structured Query Language - II
Lecture 8 - ER Model to Relational Mapping
Lecture 9 - Functional Dependencies and Normal Form
Lecture 10 - ER Model to Relational Model Mapping
Lecture 11 - Storage Structures
Lecture 12 - Indexing Techniques Single Level
Lecture 13 - Indexing Techniques Multi Level
Lecture 14 - Constraints and Triggers
Lecture 15 - Query Processing and Optimization
Lecture 16 - Query Processing and Optimization - II
Lecture 17 - Query Processing and Optimization - III
Lecture 18 - Transaction Processing Concepts
Lecture 19 - Transaction Processing and Database Manager
Lecture 20 - Foundation for Concurrency Control
Lecture 21 - Concurrency Control Part - 1
Lecture 22 - Concurrency Control Part - 2
Lecture 23 - Concurrency Control Part - 3
Lecture 24 - Concurrency Control Part - 4
Lecture 25 - Distributed Transaction Models
Lecture 26 - Basic 2-Phase and 3-phase commit protocol
Lecture 27 - Concurrency Control for Distributed Transaction
Lecture 28 - Introduction to Transaction Recovery
Lecture 29 - Recovery Mechanisms - II
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Lecture 30 - Recovery Mechanisms - III
Lecture 31 - Introduction to Data Warehousing and OLAP
Lecture 32 - Introduction to Data Warehousing and OLAP
Lecture 33 - Case Study
Lecture 34 - Case Study ORACLE and Microsoft Access
Lecture 35 - Data Mining and Knowledge Discovery
Lecture 36 - Data Mining and Knowledge Discovery Part - II
Lecture 37 - Object Oriented Databases
Lecture 38 - Object Oriented Databases - II
Lecture 39 - XML - Introductory Concepts
Lecture 40 - XML - Advanced Concepts
Lecture 41 - XML - Databases
Lecture 42 - Case Study - Part One - Database Design
Lecture 43 - Case Study - Part Two - Database Design
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NPTEL Video Course - Computer Science and Engineering - Discrete Mathematical Structures

Subject Co-ordinator - Prof. Kamala Krithivasan

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Propositional Logic
Lecture 2 - Propositional Logic (Continued)
Lecture 3 - Predicates & Quantifiers
Lecture 4 - Predicates & Quantifiers (Continued)
Lecture 5 - Logical Inference
Lecture 6 - Resolution Principles & Application to PROLOG
Lecture 7 - Methods of Proof
Lecture 8 - Normal Forms
Lecture 9 - Proving Programs Correct (Continued)
Lecture 10 - Sets
Lecture 11 - Induction
Lecture 12 - Set Operations On Strings
Lecture 13 - Relations
Lecture 14 - Graphs
Lecture 15 - Graphs (Continued)
Lecture 16 - Trees
Lecture 17 - Trees And Graphs
Lecture 18 - Special Properties Of Relations
Lecture 19 - Closure Of Relations
Lecture 20 - Closure Properties Of Relations
Lecture 21 - Order Relations
Lecture 22 - Order Relations And Equivalence Relations
Lecture 23 - Equivalence Relations And Partitions
Lecture 24 - Functions
Lecture 25 - Functions (Continued)
Lecture 26 - Functions (Continued)
Lecture 27 - Pigeonhole Principle
Lecture 28 - Permutations And Combinations
Lecture 29 - Permutations And Combinations (Continued)

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Lecture 30 - Generating Functions
Lecture 31 - Generating Functions (Continued)
Lecture 32 - Recurrence Relations
Lecture 33 - Recurrence Relations (Continued)
Lecture 34 - Recurrence Relations (Continued)
Lecture 35 - Algebras
Lecture 36 - Algebras (Continued)
Lecture 37 - Algebras (Continued)
Lecture 38 - Finite State Automaton
Lecture 39 - Finite State Automaton (Continued)
Lecture 40 - Lattices
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NPTEL Video Course - Computer Science and Engineering - Artificial Intelligence (Prof. Deepak Khemani)

Subject Co-ordinator - Prof. Deepak Khemani

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable │ MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Artificial Intelligence
Lecture 2 - Introduction to AI
Lecture 3 - AI Introduction
Lecture 4 - AI Introduction
Lecture 5 - Introduction
Lecture 6 - State Space Search - Introduction
Lecture 7 - Search - DFS and BFS
Lecture 8 - Search DFID
Lecture 9 - Heuristic Search
Lecture 10 - Hill Climbing
Lecture 11 - Solution Space Search, Beam Search
Lecture 12 - TSP Greedy Methods
Lecture 13 - Tabu Search
Lecture 14 - Optimization - I (Simulated Annealing)
Lecture 15 - Optimization - II (Genetic Algorithms)
Lecture 16 - Population based methods for Optimization
Lecture 17 - Population Based Methods II
Lecture 18 - Branch and Bound, Dijkstra's Algorithm
Lecture 19 - A* Algorithm
Lecture 20 - Admissibility of A*
Lecture 21 - A* Monotone Property, Iterative Deeping A*
Lecture 22 - Recursive Best First Search, Sequence Allignment
Lecture 23 - Pruning the Open and Closed lists
Lecture 24 - Problem Decomposition with Goal Trees
Lecture 25 - AO* Algorithm
Lecture 26 - Game Playing
Lecture 27 - Game Playing - Minimax Search
Lecture 28 - Game Playing - AlphaBeta
Lecture 29 - Game Playing - SSS *

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Lecture 30 - Rule Based Systems
Lecture 31 - Inference Engines
Lecture 32 - Rete Algorithm
Lecture 33 - Planning
Lecture 34 - Planning FSSP, BSSP
Lecture 35 - Goal Stack Planning. Sussman's Anomaly
Lecture 36 - Non-linear planning
Lecture 37 - Plan Space Planning
Lecture 38 - GraphPlan
Lecture 39 - Constraint Satisfaction Problems
Lecture 40 - CSP continued
Lecture 41 - Knowledge-based systems
Lecture 42 - Knowledge-based Systems, PL
Lecture 43 - Propositional Logic
Lecture 44 - Resolution Refutation for PL
Lecture 45 - First-order Logic (FOL)
Lecture 46 - Reasoning in FOL
Lecture 47 - Backward chaining
Lecture 48 - Resolution for FOL
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NPTEL Video Course - Computer Science and Engineering - NOC:Programming, Data Structures and Algorithms

Subject Co-ordinator - Prof. Hema A Murthy, Prof. Shankar Balachandran, Dr. N.S. Narayanaswamy

Co-ordinating Institute - IIT - Madras

Lecture 1 - Introduction to Computers and Programming
Lecture 2 - Writing your first program
Lecture 3 - Variables, Operators and Expressions
Lecture 4 - Variable declarations, more operators and precedence
Lecture 5 - Input and Output Statements
Lecture 6 - Conditionals
Lecture 7 - Loops
Lecture 8 - Video Solution to Digital Root Programming Assignment
Lecture 9 - Introduction to arrays
Lecture 10 - Working with 1D arrays
Lecture 11 - Find prime numbers
Lecture 12 - Debugging demo
Lecture 13 - Multi-dimensional arrays
Lecture 14 - Pointers
Lecture 15 - More on pointers
Lecture 16 - Arrays and pointer arithmetic
Lecture 17 - Introduction to Strings
Lecture 18 - More on Strings
Lecture 19 - Video Solution to Print Elements of a Matrix in Spiral Order Programming Assignment
Lecture 20 - Introduction to functions
Lecture 21 - More details on functions
Lecture 22 - Arguments, variables and parameters
Lecture 23 - Pass parameters by reference
Lecture 24 - Recursive functions
Lecture 25 - Running time of a program
Lecture 26 - Computing time complexity
Lecture 27 - Video Solution to Palindrome Checker Programming Assignment
Lecture 28 - Algorithms and Powering
Lecture 29 - Polynomial evaluation and multiplication
Lecture 30 - Linear and Binary Search Analysis
Lecture 31 - Analysis of minimum and maximum in an array
Lecture 32 - Sorting I
Lecture 33 - Sorting II

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Lecture 34 - Finding i-th smallest number
Lecture 35 - Video Solution to Sorting words Programming Assignment
Lecture 36 - Structures
Lecture 37 - More on structures
Lecture 38 - Using structures and pointers to structures
Lecture 39 - Dynamic memory allocation
Lecture 40 - Linked Lists
Lecture 41 - Brief introduction to C++
Lecture 42 - Data Structures
Lecture 43 - Lists
Lecture 44 - Supplementary Lesson
Lecture 45 - Video Solution to Implementing a Hash Table ADT Programming Assignment
Lecture 46 - Stacks
Lecture 47 - Queues
Lecture 48 - Trees
Lecture 49 - Tree traversal
Lecture 50 - Binary Search Trees
Lecture 51 - Heaps
Lecture 52 - Graphs and Representation
Lecture 53 - Supplementary Lesson
Lecture 54 - Video Solution to the Queue in a Hospital Programming Assignment
Lecture 55 - Greedy Algorithms
Lecture 56 - Dynamic Programming
Lecture 57 - Matrix Chain Multiplication
Lecture 58 - Dijkstra's Algorithm
Lecture 59 - Boyer-Moore String Matching Algorithm
Lecture 60 - File I/O
Lecture 61 - Modular Programming
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NPTEL Video Course - Computer Science and Engineering - NOC:Introduction to Information Security I

Subject Co-ordinator - Prof. V. Kamakoti

Co-ordinating Institute - IIT - Madras

Lecture 1 - Module 1 - Part 0 - Introduction to the Course
Lecture 2 - Module 1 - Part 1 - Definition of Information Security
Lecture 3 - Module 1 - Part 2 - Information Security Terminologies
Lecture 4 - Module 1 - Part 3 - Goals of Information Security
Lecture 5 - Module 1 - Part 4 - Implementation Issues of the Goals of Information Security - I
Lecture 6 - Module 1 - Part 5 - Implementation Issues of the Goals of Information Security - II
Lecture 7 - Module 1 - Part 6 - Control Mechanisms for Information Security - I
Lecture 8 - Module 1 - Part 7 - Access Control - Administrative and Technical
Lecture 9 - Module 1 - Part 8 - Passwords - Are they secure? - I
Lecture 10 - Module 1 - Part 9 - Access Control - Administrative and Technical
Lecture 11 - Module 1 - Part 10 - Passwords - Are they secure? - III
Lecture 12 - Module 1 - Part 11 - Multifactor Authentication - Challenges
Lecture 13 - Module 1 - Part 12 - Application Level Control and Information Security Planning
Lecture 14 - Module 1 - Part 13 - Information Security - Policy, Standard and Practice
Lecture 15 - Module 1 - Part 14 - Policies governing Issues, Roles and Responsibilities
Lecture 16 - Module 1 - Part 15 - Managing changes in Information Security Policies
Lecture 17 - Module 1 - Part 16 - Spheres of Information Security
Lecture 18 - Module 2 - Part 1 - Protecting your Personal Computer - I
Lecture 19 - Module 2 - part 2 - Protecting your Personal Computer - II
Lecture 20 - Module 2 - Part 3 - Protecting your Personal Computer - III
Lecture 21 - Module 2 - Part 4 - Cloud Computing (Basic Definitions) - I
Lecture 22 - Module 2 - Part 5 - Cloud Computing (Deployment) - II
Lecture 23 - Module 2 - Part 6 - Cloud Computing (Security Issues) - III
Lecture 24 - Module 2 - Part 7 - Cloud Computing (Trust and Risk) - IV
Lecture 25 - Module 2 - Part 8 - Cloud Computing (Security and Privacy Issues) - V
Lecture 26 - Module 2 - Part 9 - Cloud Computing (Security and Privacy Issues) - VI
Lecture 27 - Module 2 - Part 10 - Cloud Computing (Application and Data level security) - VII
Lecture 28 - Module 2 - Part 11 - Cloud Computing (Summary) - VIII
Lecture 29 - Module 2 - Part 12 - Standard I
Lecture 30 - Module 2 - Part 13 - Standard II
Lecture 31 - Module 2 - Part 14 - Standard III
Lecture 32 - Module 3 - Part 1
Lecture 33 - Module 3 - Part 2

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Lecture 34 - Module 3 - Part 3
Lecture 35 - Module 3 - Part 4
Lecture 36 - Module 3 - Part 5
Lecture 37 - Module 3 - Part 6
Lecture 38 - Module 3 - Part 7
Lecture 39 - Module 3 - Part 8
Lecture 40 - Module 3 - Part 9
Lecture 41 - Module 4 - Part 1
Lecture 42 - module 4 - Part 2
Lecture 43 - Module 4 - Part 3
Lecture 44 - Module 4 - Part 4
Lecture 45 - Module 4 - Part 5
Lecture 46 - Module 4 - Part 6
Lecture 47 - Module 4 - Part 7
Lecture 48 - Module 4 - Part 8
Lecture 49 - Module 4 - Part 9
Lecture 50 - Module 4 - Part 10
Lecture 51 - Module 5 - Part 1
Lecture 52 - Module 5 - Part 2
Lecture 53 - Module 5 - Part 3
Lecture 54 - Module 5 - Part 4
Lecture 55 - Module 5 - Part 5
Lecture 56 - Module 5 - Part 6
Lecture 57 - Module 5 - Part 7
Lecture 58 - Module 6 - Part 1
Lecture 59 - Module 6 - Part 2
Lecture 60 - Module 6 - Part 3
Lecture 61 - Module 6 - Part 4
Lecture 62 - Module 6 - Part 5
Lecture 63 - Module 6 - Part 6
Lecture 64 - Module 6 - Part 7
Lecture 65 - Module 6 - Part 8
```

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NPTEL Video Course - Computer Science and Engineering - NOC:Programming and Data structures (PDS)

Subject Co-ordinator - Dr. N S. Narayanaswamy

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - A Simple C Program for Sorting
Lecture 2 - Review of Structures, Pointers, and Functions
Lecture 3 - Recursion
Lecture 4 - Abstract Data Types-Data + Methods
Lecture 5 - List Data Type
Lecture 6 - Access and update methods
Lecture 7 - Doubly Linked List Data Type
Lecture 8 - Doubly Linked Lists and Arrays
Lecture 9 - ADT Stacks
Lecture 10 - Checking of Balanced Parenthesis
Lecture 11 - Infix and Postfix expressions and Expression evaluation
Lecture 12 - Queue ADT Definition and Implementation
Lecture 13 - Merging using Queue ADT and Queue types
Lecture 14 - Tree ADT and Traversals
Lecture 15 - Binary Tree ADT and traversals
Lecture 16 - Tree Applications
Lecture 17 - Binary Search Trees
Lecture 18 - Heaps

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NPTEL Video Course - Computer Science and Engineering - NOC:Design and Analysis of Algorithms

Subject Co-ordinator - Prof. Madhavan Mukund

Co-ordinating Institute - Chennai Mathematical Institute

Lecture 1 - Course Outline
Lecture 2 - Example
Lecture 3 - Example
Lecture 4 - Example
Lecture 5 - Introduction and motivation
Lecture 6 - Input size, worst case, average case
Lecture 7 - Quantifying efficiency
Lecture 8 - Examples
Lecture 9 - Arrays and lists
Lecture 10 - Searching in an array
Lecture 11 - Selection Sort
Lecture 12 - Insertion sort
Lecture 13 - Merge sort
Lecture 14 - Merge sort - analysis
Lecture 15 - Quicksort
Lecture 16 - Quicksort - analysis
Lecture 17 - Sorting - Concluding remarks
Lecture 18 - Introduction to graphs
Lecture 19 - Representing graphs
Lecture 20 - Breadth first search (BFS)
Lecture 21 - Depth first search (DFS)
Lecture 22 - Applications of BFS and DFS
Lecture 23 - Directed acylic graphs
Lecture 24 - Directed acylic graphs
Lecture 25 - Single source shortest paths
Lecture 26 - Dijkstras algorithm
Lecture 27 - Negative edge weights
Lecture 28 - All pairs shortest paths
Lecture 29 - Minimum Cost Spanning Trees
Lecture 30 - Prims Algorithm
Lecture 31 - Kruskals algorithm
Lecture 32 - Union-Find using arrays
Lecture 33 - Union-Find using pointers

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Lecture 34 - Priority queues
Lecture 35 - Heaps
Lecture 36 - Heaps
Lecture 37 - Counting inversions
Lecture 38 - Closest pair of points
Lecture 39 - Binary Search Trees
Lecture 40 - Balanced search trees
Lecture 41 - Interval scheduling
Lecture 42 - Scheduling with deadlines
Lecture 43 - Huffman codes
Lecture 44 - Introduction to dynamic programming
Lecture 45 - Memoization
Lecture 46 - Grid Paths
Lecture 47 - Common subwords and subsequences
Lecture 48 - Edit distance
Lecture 49 - Matrix multiplication
Lecture 50 - Linear Programming
Lecture 51 - LP modelling
Lecture 52 - LP modelling
Lecture 53 - Network Flows
Lecture 54 - Reductions
Lecture 55 - Checking Algorithms
Lecture 56 - P and NP
```

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NPTEL Video Course - Computer Science and Engineering - NOC:Programming, Data Structures and Algorithms (Aric

Subject Co-ordinator - Dr. N S. Narayanaswamy, Prof. Shankar Balachandran, Prof. Hema A Murthy

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable │ MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to Computers and Programming
Lecture 2 - Writing your first program
Lecture 3 - Variables, Operators and Expressions
Lecture 4 - Variable declarations, more operators and precedence
Lecture 5 - Input and Output Statements
Lecture 6 - Conditionals
Lecture 7 - Loops
Lecture 8 - Introduction to arrays
Lecture 9 - Working with 1D arrays
Lecture 10 - Find prime numbers
Lecture 11 - Debugging demo
Lecture 12 - Multi-dimensional arrays
Lecture 13 - Pointers
Lecture 14 - More on pointers
Lecture 15 - Arrays and pointer arithmetic
Lecture 16 - Introduction to Strings
Lecture 17 - More on Strings
Lecture 18 - Introduction to functions
Lecture 19 - More details on functions
Lecture 20 - Arguments, variables and parameters
Lecture 21 - Pass parameters by reference
Lecture 22 - Recursive Functions
Lecture 23 - C control structures, functional specification of programs
Lecture 24 - Complexity Analysis using Sum and Product Rule
Lecture 25 - Complexity Analysis of Recursive Functions
Lecture 26 - Algorithms and Powering
Lecture 27 - Polynomial evaluation and multiplication
Lecture 28 - Linear and Binary Search Analysis
Lecture 29 - Analysis of minimum and maximum in an array

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Lecture 30 - Sorting I: Insertion, Merge
Lecture 31 - Sorting II: Counting, Radix
Lecture 32 - Finding i-th smallest number
Lecture 33 - Structures
Lecture 34 - More on Structures
Lecture 35 - Using structures and pointers to structures
Lecture 36 - Dynamic memory allocation
Lecture 37 - Linked List
Lecture 38 - Brief introduction to C++: Classes and objects
Lecture 39 - Abstract Data Types
Lecture 40 - More on ADT
Lecture 41 - Stacks: Last In First Out
Lecture 42 - Queues: First In First
Lecture 43 - Trees
Lecture 44 - Tree Traversal
Lecture 45 - Binary Search
Lecture 46 - Heaps
Lecture 47 - Graphs and Representations
Lecture 48 - Greedy Algorithms
Lecture 49 - Dynamic Programming
Lecture 50 - Matrix Chain Multiplication
Lecture 51 - Hash Tables
Lecture 52 - Graph Algorithms: Dijkstras Algorithm and Prims Algorithm
Lecture 53 - Graph Traversals: BFS,DFS and Articulation Points
Lecture 54 - File I/O
Lecture 55 - Modular Programming
```

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NPTEL Video Course - Computer Science and Engineering - NOC:Computer Architecture

Subject Co-ordinator - Prof.Madhu Mutyam

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to Computer Architecture
Lecture 2 - Quantitative Principles of Computer Design
Lecture 3 - Instruction Set Principles-Part 1
Lecture 4 - Instruction Set Principles-Part 2
Lecture 5 - Instruction Set Principles-Part 3
Lecture 6 - Cache Memory Hierarchy - Part 1
Lecture 7 - Cache Memory Hierarchy - Part 2
Lecture 8 - Cache Memory Hierarchy - Part 3
Lecture 9 - Cache Memory Hierarchy - Part 4
Lecture 10 - Main Memory Design - Part 1
Lecture 11 - Main Memory Design - Part 2
Lecture 12 - Main Memory Design - Part 3
Lecture 13 - Fundamentals of Pipelining - Part 1
Lecture 14 - Fundamentals of Pipelining - Part 2
Lecture 15 - Fundamentals of Pipelining - Part 3
Lecture 16 - Fundamentals of Pipelining - Part 4
Lecture 17 - Fundamentals of Pipelining - Part 5
Lecture 18 - Scalar to Superscalar pipeline
Lecture 19 - Instruction Dependencies
Lecture 20 - Compiler optimizations for Exposing ILP
Lecture 21 - Advanced Branch Prediction Techniques - Part 1
Lecture 22 - Advanced Branch Prediction Techniques - Part 2
Lecture 23 - Superscalar Organization
Lecture 24 - Register Renaming
Lecture 25 - Tomasulo Algorithm
Lecture 26 - Dynamic Execution Core
Lecture 27 - Multi threading
Lecture 28 - Multicore Processor Architecture
Lecture 29 - Cache Coherence

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Lecture 30 - Cache Coherence Protocol Design
Lecture 31 - Synchronization
Lecture 32 - Memory Consistency - Part 1
Lecture 33 - Memory Consistency - Part 2

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NPTEL Video Course - Computer Science and Engineering - NOC:Model Checking

Subject Co-ordinator - Prof. B. Srivathsan

Co-ordinating Institute - Chennai Mathematical Institute

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Course Overview
Lecture 2 - Module 1 - Modeling code behaviour
Lecture 3 - Module 2 - Modeling hardware circuits
Lecture 4 - Module 3 - Modeling data-dependent programs
Lecture 5 - Module 4 - Modeling concurrent systems
Lecture 6 - Summary
Lecture 7 - Module 1 - Model checking tools
Lecture 8 - Module 2 - Simple models in NuSMV
Lecture 9 - Module 3 - Hardware verification using NuSMV
Lecture 10 - Module 4 - Modeling concurrent systems in NuSMV
Lecture 11 - Summary.
Lecture 12 - Module 1 - A problem in concurrency
Lecture 13 - Module 2 - What is a property?
Lecture 14 - Module 3 - Invariants
Lecture 15 - Module 4 - Safety properties
Lecture 16 - Module 5 - Liveness properties
Lecture 17 - Summary..
Lecture 18 - Module 1 - Road map
Lecture 19 - Module 2 - A gentle introduction to automata
Lecture 20 - Module 3 - Simple properties of finite automata
Lecture 21 - Module 4 - Safety properties described by automata
Lecture 22 - Summary...
Lecture 23 - Module 1 - Specifying properties
Lecture 24 - Module 2 - Omega-regular expressions
Lecture 25 - Module 3 - Bchi automata
Lecture 26 - Module 4 - Simple properties of Bchi automata
Lecture 27 - Summary....
Lecture 28 - Module 1 - Overview
Lecture 29 - Module 2 - Omega-regular expressions to NBA

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Lecture 30 - Module 3 - Checking emptiness of NBA
Lecture 31 - Module 4 - Generalized NBA
Lecture 32 - Summary.....
Lecture 33 - Module 1 - Introduction to LTL
Lecture 34 - Module 2 - Semantics of LTL
Lecture 35 - Module 3 - A puzzle
Lecture 36 - Summary.
Lecture 37 - Module 1 - Automata based LTL model-checking
Lecture 38 - Module 2 - LTL to NBA
Lecture 39 - Module 3 - Automaton construction
Lecture 40 - Summary..
Lecture 41 - Module 1 - Tree view of a transition system
Lecture 42 - Module 2 - CTL*
Lecture 43 - Module 3 - CTL
Lecture 44 - summary...
Lecture 45 - Module 1 - Adequate CTL formulae
Lecture 46 - Module 2 - EX, EU, EG
Lecture 47 - Module 3 - Final algorithm
Lecture 48 - Module 4 - State-space explosion
Lecture 49 - Summary....
Lecture 50 - Module 1 - Introduction to BDDs
Lecture 51 - Module 2 - Ordered BDDs
Lecture 52 - Module 3 - Representing transition systems as OBDDs
Lecture 53 - Summary.....
Lecture 54 - Timed transition systems
Lecture 55 - Concluding remarks
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NPTEL Video Course - Computer Science and Engineering - NOC:Functional Programming in Haskell

Subject Co-ordinator - Prof. Madhavan Mukund, Prof. S P Suresh

Co-ordinating Institute - Chennai Mathematical Institute

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Functions
Lecture 2 - Types
Lecture 3 - Haskell
Lecture 4 - Running Haskell programs
Lecture 5 - Currying
Lecture 6 - Examples
Lecture 7 - Lists
Lecture 8 - Functions on lists
Lecture 9 - Characters and strings
Lecture 10 - Tuples
Lecture 11 - Computation as rewriting
Lecture 12 - Polymorphism and higher-order functions
Lecture 13 - Map and filter
Lecture 14 - List comprehension
Lecture 15 - Folding through a list
Lecture 16 - Measuring efficiency
Lecture 17 - Sorting
Lecture 18 - Using infinite lists
Lecture 19 - Conditional polymorphism
Lecture 20 - Defining functions in ghci
Lecture 21 - User-defined datatypes
Lecture 22 - Abstract datatypes
Lecture 23 - Modules
Lecture 24 - Recursive data types
Lecture 25 - Binary search trees
Lecture 26 - Balanced search trees
Lecture 27 - Arrays
Lecture 28 - Input/Output

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NPTEL Video Course - Computer Science and Engineering - Virtual Reality

Subject Co-ordinator - Prof. Steven LaVall

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Course mechanics
Lecture 2 - Goals and VR definitions
Lecture 3 - Historical perspective
Lecture 4 - Birds-eye view (general)
Lecture 5 - Birds-eye view (general) (Continued...)
Lecture 6 - Birds-eye view (hardware)
Lecture 7 - Birds-eye view (software)
Lecture 8 - Birds-eye view (sensation and perception)
Lecture 9 - Geometric modeling
Lecture 10 - Transforming models
Lecture 11 - Matrix algebra and 2D rotations
Lecture 12 - 3D rotations and yaw, pitch, and roll
Lecture 13 - 3D rotations and yaw, pitch, and roll (Continued...)
Lecture 14 - Axis-angle representations
Lecture 15 - Quaternions
Lecture 16 - Converting and multiplying rotations
Lecture 17 - Converting and multiplying rotations (Continued...)
Lecture 18 - Homogeneous transforms
Lecture 19 - The chain of viewing transforms
Lecture 20 - Eye transforms
Lecture 21 - Eye transforms (Continued...)
Lecture 22 - Canonical view transform
Lecture 23 - Viewport transform
Lecture 24 - Viewport transform (Continued...)
Lecture 25 - Three interpretations of light
Lecture 26 - Refraction
Lecture 27 - Simple lenses
Lecture 28 - Diopters
Lecture 29 - Imaging properties of lenses

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Lecture 30 - Lens aberrations
Lecture 31 - Optical system of eyes
Lecture 32 - Photoreceptors
Lecture 33 - Sufficient resolution for VR
Lecture 34 - Light intensity
Lecture 35 - Eye movements
Lecture 36 - Eye movements (Continued...)
Lecture 37 - Eye movement issues for VR
Lecture 38 - Neuroscience of vision
Lecture 39 - Depth perception
Lecture 40 - Depth perception (Continued...)
Lecture 41 - Motion perception
Lecture 42 - Frame rates and displays
Lecture 43 - Frame rates and displays (Continued...)
Lecture 44 - Overview
Lecture 45 - Orientation tracking
Lecture 46 - Tilt drift correction
Lecture 47 - Yaw drift correction
Lecture 48 - Tracking with a camera
Lecture 49 - Perspective n-point problem
Lecture 50 - Filtering
Lecture 51 - Lighthouse approach
Lecture 52 - Visual Rendering-Overview
Lecture 53 - Visual Rendering-overview (Continued...)
Lecture 54 - Shading models
Lecture 55 - Rasterization
Lecture 56 - Pixel shading
Lecture 57 - VR-specific problems
Lecture 58 - Distortion shading
Lecture 59 - Post-rendering image warp
Lecture 60 - Physics and physiology
Lecture 61 - Auditory perception
Lecture 62 - Auditory localization
Lecture 63 - Rendering
Lecture 64 - Spatialization and display
Lecture 65 - Combining other senses
Lecture 66 - Interfaces -overview
Lecture 67 - Locomotion
Lecture 68 - Manipulation
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Lecture 69 - System control
Lecture 70 - Social interaction
Lecture 71 - Evaluation of VR Systems

NPTEL Video Course - Computer Science and Engineering - NOC:Introduction to Machine Learning (Sponsored by Ar

Subject Co-ordinator - Dr. Balaraman Ravindran

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - A brief introduction to machine learning
Lecture 2 - Supervised Learning
Lecture 3 - Unsupervised Learning
Lecture 4 - Reinforcement Learning
Lecture 5 - Probability Basics - 1
Lecture 6 - Probability Basics - 2
Lecture 7 - Linear Algebra - 1
Lecture 8 - Linear Algebra - 2
Lecture 9 - Statistical Decision Theory - Regression
Lecture 10 - Statistical Decision Theory - Classification
Lecture 11 - Bias-Variance
Lecture 12 - Linear Regression
Lecture 13 - Multivariate Regression
Lecture 14 - Subset Selection 1
Lecture 15 - Subset Selection 2
Lecture 16 - Shrinkage Methods
Lecture 17 - Principal Components Regression
Lecture 18 - Partial Least Squares
Lecture 19 - Linear Classification
Lecture 20 - Logistic Regression
Lecture 21 - Linear Discriminant Analysis 1
Lecture 22 - Linear Discriminant Analysis 2
Lecture 23 - Linear Discriminant Analysis 3
Lecture 24 - Optimization
Lecture 25 - Perceptron Learning
Lecture 26 - SVM - Formulation
Lecture 27 - SVM - Interpretation & Analysis
Lecture 28 - SVMs for Linearly Non Separable Data
Lecture 29 - SVM Kernels

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Lecture 30 - SVM - Hinge Loss Formulation
Lecture 31 - Weka Tutorial
Lecture 32 - Early Models
Lecture 33 - Backpropogation - I
Lecture 34 - Backpropogation - II
Lecture 35 - Initialization, Training and Validation
Lecture 36 - Maximum Likelihood Estimate
Lecture 37 - Priors and MAP Estimate
Lecture 38 - Bayesian Parameter Estimation
Lecture 39 - Introduction
Lecture 40 - Regression Trees
Lecture 41 - Stopping Criteria and Pruning
Lecture 42 - Loss Functions for Classification
Lecture 43 - Categorical Attributes
Lecture 44 - Multiway Splits
Lecture 45 - Missing Values, Imputation and Surrogate Splits
Lecture 46 - Instability, Smoothness and Repeated Subtrees
Lecture 47 - Tutorial
Lecture 48 - Evaluation Measures I
Lecture 49 - Bootstrapping and Cross Validation
Lecture 50 - 2 Class Evaluation Measures
Lecture 51 - The ROC Curve
Lecture 52 - Minimum Description Length and Exploratory Analysis
Lecture 53 - Introduction to Hypothesis Testing
Lecture 54 - Basic Concepts
Lecture 55 - Sampling Distributions and the Z Test
Lecture 56 - Student's t-test
Lecture 57 - The Two Sample and Paired Sample t-tests
Lecture 58 - Confidence Intervals
Lecture 59 - Bagging, Committee Machines and Stacking
Lecture 60 - Boosting
Lecture 61 - Gradient Boosting
Lecture 62 - Random Forest
Lecture 63 - Naive Bayes
Lecture 64 - Bayesian Networks
Lecture 65 - Undirected Graphical Models - Introduction
Lecture 66 - Undirected Graphical Models - Potential Functions
Lecture 67 - Hidden Markov Models
Lecture 68 - Variable Elimination
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Lecture 69 - Belief Propagation
Lecture 70 - Partitional Clustering
Lecture 71 - Hierarchical Clustering
Lecture 72 - Threshold Graphs
Lecture 73 - The BIRCH Algorithm
Lecture 74 - The CURE Algorithm
Lecture 75 - Density Based Clustering
Lecture 76 - Gaussian Mixture Models
Lecture 77 - Expectation Maximization
Lecture 78 - Expectation Maximization (Continued...)
Lecture 79 - Spectral Clustering
Lecture 80 - Learning Theory
Lecture 81 - Frequent Itemset Mining
Lecture 82 - The Apriori Property
Lecture 83 - Introduction to Reinforcement Learning
Lecture 84 - RL Framework and TD Learning
Lecture 85 - Solution Methods and Applications
Lecture 86 - Multi-class Classification
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NPTEL Video Course - Computer Science and Engineering - NOC:Artificial Intelligence: Knowledge Representation

Subject Co-ordinator - Prof. Deepak Khemani

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction
Lecture 2 - Abductive Inferences and Expectations
Lecture 3 - On Machine Learning
Lecture 4 - A New Test of Intelligence?
Lecture 5 - The World According to Us
Lecture 6 - From Particles to Concepts
Lecture 7 - The Domains for Reasoning
Lecture 8 - Hierarchies in Representation
Lecture 9 - Logic and Representation: A Quick Tour
Lecture 10 - Symbols and Thought
Lecture 11 - From Gears to Symbols
Lecture 12 - Truth, Logic, and Provability
Lecture 13 - A Syntactic Machine
Lecture 14 - Entailment and Proof
Lecture 15 - The Languages of Logic
Lecture 16 - Patterns in Arguments
Lecture 17 - Rules of Inference
Lecture 18 - Propositional Logic
Lecture 19 - Propositional Logic: Syntax
Lecture 20 - Propositional Logic: Semantics
Lecture 21 - Proofs: Natural Deduction
Lecture 22 - The Deduction Theorem
Lecture 23 - Models
Lecture 24 - The Tableau Method
Lecture 25 - First Order Logic
Lecture 26 - First Order Logic: Syntax
Lecture 27 - FOL: Universal Instantiation
Lecture 28 - First Order Logic: Semantics
Lecture 29 - FOL: Truth Assignments

```
Lecture 30 - Modified Modus Ponens
Lecture 31 - The Unification Algorithm
Lecture 32 - Skolemization
Lecture 33 - Expert Systems
Lecture 34 - Backward Chaining Systems
Lecture 35 - Deductive Retrieval
Lecture 36 - The Resolution Refutation Method
Lecture 37 - Clause Form in FOL
Lecture 38 - Resolution Refutation in FOL
Lecture 39 - First Order Logic with Equality
Lecture 40 - Who was the surgeon?
Lecture 41 - Consistency vs. Completeness
Lecture 42 - Logic Programming
Lecture 43 - Arithmetic
Lecture 44 - Horn Clauses and Prolog
Lecture 45 - SLD Derivation = Backward Chaining
Lecture 46 - Programming in Logic
Lecture 47 - Prolog: Programming in Logic
Lecture 48 - Prolog: Procedural Interpretation
Lecture 49 - Prolog: Query Evaluation
Lecture 50 - Prolog: Unifying Terms
Lecture 51 - Prolog: Goal Order
Lecture 52 - Prolog: Tabling
Lecture 53 - Prolog: Negation by Failure
Lecture 54 - Prolog: The Cut Operator
Lecture 55 - Rule Based Expert Systems
Lecture 56 - The OPS5 Language
Lecture 57 - Match, Resolve, Execute
Lecture 58 - Conflict Resolution Strategies
Lecture 59 - The Rete Algorithm
Lecture 60 - The Rete Net
Lecture 61 - The Rete Net : Examples
Lecture 62 - Knowledge Representation
Lecture 63 - Synonyms, Antonyms, Hyponyms, Meronyms
Lecture 64 - Binary Relations
Lecture 65 - Describing Family Relations
Lecture 66 - Recursive Descriptions
Lecture 67 - Abstract Entities
Lecture 68 - Reification: Units of Measurement
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Lecture 69 - Semantic Nets and Knowledge Graphs
Lecture 70 - DL: Description Logics
Lecture 71 - Defining New Concepts and Roles
Lecture 72 - The Sentences in DL
Lecture 73 - A Family of Logics
Lecture 74 - DL: Some Examples
Lecture 75 - ALC Tableau
Lecture 76 - Model Checking in ALC
Lecture 77 - ALC Tableau: Examples
Lecture 78 - Language Independent Represntation
Lecture 79 - Conceptual Dependency Theory
Lecture 80 - CD States
Lecture 81 - Inferences in MARGIE
Lecture 82 - CD: Actions
Lecture 83 - English to CD
Lecture 84 - Representing Complex Verbs
Lecture 85 - Semantic Parsing of Language
Lecture 86 - Knowledge Structures
Lecture 87 - Scripts
Lecture 88 - SAM: Script Apploer Mechanism
Lecture 89 - A VIP Visit
Lecture 90 - Invoking Scripts
Lecture 91 - Goals, Plans, and Actions
Lecture 92 - Goal Interactions
Lecture 93 - Explanation Driven Understanding
Lecture 94 - Tussle Over a Bicycle
Lecture 95 - Plan Applier Mechanism (PAM)
Lecture 96 - Requests and Rule Instances
Lecture 97 - Managing Rule Instances
Lecture 98 - Knowledge Structures: Frames
Lecture 99 - Inheritance
Lecture 100 - A Frame System for Travel Planning
Lecture 101 - Inheritance in Taxonomies
Lecture 102 - Default Reasoning
Lecture 103 - Closed World Assumption
Lecture 104 - Circumscription
Lecture 105 - Default Logic
Lecture 106 - Autoepistemic Reasoning
Lecture 107 - The Event Calculus
```

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Lecture 108 - The Effects of Events
Lecture 109 - Epistemic Logic
Lecture 110 - Kripke Structures: Possible Worlds Semantics
Lecture 111 - The Muddy Children Puzzle
Lecture 112 - The Effects of Epistemic Actions
Lecture 113 - Reasoning with Beliefs

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NPTEL Video Course - Computer Science and Engineering - NOC:Information Security - II

Subject Co-ordinator - Prof. V. Kamakoti

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Experimental Setup
Lecture 2 - Need for Secure Systems
Lecture 3 - Ignorance of A is Sin of B
Lecture 4 - Function calls and Stacks
Lecture 5 - Stack Smashing
Lecture 6 - Virtual Machine Based Rootkits
Lecture 7 - Security and Architecture
Lecture 8 - Structured Computer Organization Completed
Lecture 9 - X86 ISA - Part1
Lecture 10 - X86 ISA - Part 2
Lecture 11 - X86 Protected Mode
Lecture 12 - X86 Memory Segmentation
Lecture 13 - Process Isolation using Segmentation
Lecture 14 - Paging and Virtual Memory
Lecture 15 - Task Switching and Interrupt Service
Lecture 16 - Memory Segmentation Deep dive - Part 1
Lecture 17 - Memory Segmentation Deep dive - Part 2
Lecture 18 - Memory Segmentation Deep dive - Part 3
Lecture 19 - Memory Segmentation Deep dive - Part 4
Lecture 20 - Segmentation Recap
Lecture 21 - Lab 1 - Part 1
Lecture 22 - Lab 1 - Part 2
Lecture 23 - Lab 1 - Part 3
Lecture 24 - ISR Recap
Lecture 25 - Lab 2 - Part 1
Lecture 26 - Lab 2 - Part 2
Lecture 27 - Memory Management Recap
Lecture 28 - Lab 3 - Part 1
Lecture 29 - Lab 3 - Part 2

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```
Lecture 30 - Task Switch recap
Lecture 31 - Lab 4 - Part 1
Lecture 32 - Lab 4 - Part 2
Lecture 33 - Lab 4 - Part 3
Lecture 34 - Lab 4 - Part 4
Lecture 35 - Introduction to Basic Cryptography
Lecture 36 - Public Key Cryptography
Lecture 37 - Freescale ARM iMX6 Processor
Lecture 38 - High Assurance Boot in iMX6
Lecture 39 - Case Study
Lecture 40 - Basics of Networking
Lecture 41 - Network Processor Vs General Purpose Processor
Lecture 42 - Network Processor Architecture
```

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NPTEL Video Course - Computer Science and Engineering - NOC:Algorithms for Big Data

Subject Co-ordinator - Prof. John Augustine

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Basic definitions
Lecture 2 - Conditional probability
Lecture 3 - Example problems
Lecture 4 - Karger's mincut algorithm
Lecture 5 - Analysis of Karger's mincut algorithm
Lecture 6 - Random variables
Lecture 7 - Randomized quicksort
Lecture 8 - Problem solving video - The rich get richer
Lecture 9 - Problem solving video - Monty Hall problem
Lecture 10 - Bernoulli, Binomial and Geometric distributions
Lecture 11 - Tail Bounds
Lecture 12 - Application of Chernoff bound
Lecture 13 - Application of Chebyshev's inequality
Lecture 14 - Intro to Big Data Algorithms
Lecture 15 - SAT Problem
Lecture 16 - Classification of States
Lecture 17 - Stationary Distribution of a Markov Chain
Lecture 18 - Celebrities Case Study
Lecture 19 - Random Walks on Undirected Graphs
Lecture 20 - Intro to Streaming, Morris Algorithm
Lecture 21 - Reservoir Sampling
Lecture 22 - Approximate Median
Lecture 23 - Overview
Lecture 24 - Balls, bins, hashing
Lecture 25 - Chain hashing, SUHA, Power of Two choices
Lecture 26 - Bloom filter
Lecture 27 - Pairwise independence
Lecture 28 - Estimating expectation of continuous function
Lecture 29 - Universal hash functions

```
Lecture 30 - Perfect hashing
Lecture 31 - Count-min filter for heavy hitters in data streams
Lecture 32 - Problem solving video - Doubly Stochastic Transition Matrix
Lecture 33 - Problem solving video - Random Walks on Linear Structures
Lecture 34 - Problem solving video - Lollipop Graph
Lecture 35 - Problem solving video - Cat And Mouse
Lecture 36 - Estimating frequency moments
Lecture 37 - Property testing framework
Lecture 38 - Testing Connectivity
Lecture 39 - Enforce and Test Introduction
Lecture 40 - Testing if a graph is a biclique
Lecture 41 - Testing bipartiteness
Lecture 42 - Property testing and random walk algorithms
Lecture 43 - Testing if a graph is bipartite (using random walks)
Lecture 44 - Graph streaming algorithms: Introduction
Lecture 45 - Graph streaming algorithms: Matching
Lecture 46 - Graph streaming algorithms: Graph sparsification
Lecture 47 - MapReduce
Lecture 48 - K-Machine Model (aka Pregel Model)
```

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NPTEL Video Course - Computer Science and Engineering - NOC:Reinforcement Learning

Subject Co-ordinator - Dr. B. Ravindran

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable


```
Lecture 1 - Tutorial 1 - Probability Basics 1
Lecture 2 - Tutorial 1 - Probability Basics 2
Lecture 3 - Tutorial 2 - Linear algebra - 1
Lecture 4 - Tutorial 2 - Linear algebra - 2
Lecture 5 - Introduction to RL
Lecture 6 - RL Framework and applications
Lecture 7 - Introduction to Immediate RL
Lecture 8 - Bandit Optimalities
Lecture 9 - Value function based methods
Lecture 10 - UCB 1
Lecture 11 - Concentration Bounds
Lecture 12 - UCB 1 Theorem
Lecture 13 - PAC Bounds
Lecture 14 - Median Elimination
Lecture 15 - Thompson Sampling
Lecture 16 - Policy Search
Lecture 17 - REINFORCE
Lecture 18 - Contextual Bandits
Lecture 19 - Full RL Introduction
Lecture 20 - Returns, Value Functions and MDPs
Lecture 21 - MDP Modelling
Lecture 22 - Bellman Equation
Lecture 23 - Bellman Optimality Equation
Lecture 24 - Cauchy Sequence and Green's Equation
Lecture 25 - Banach Fixed Point Theorem
Lecture 26 - Convergence Proof
Lecture 27 - Lpi Convergence
Lecture 28 - Value Iteration
Lecture 29 - Policy Iteration
```

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```
Lecture 30 - Dynamic Programming
Lecture 31 - Monte Carlo
Lecture 32 - Control in Monte Carlo
Lecture 33 - Off Policy MC
Lecture 34 - UCT
Lecture 35 - TD(0)
Lecture 36 - TD(0) Control
Lecture 37 - Q-Learning
Lecture 38 - Afterstate
Lecture 39 - Eligibility Traces
Lecture 40 - Backward View of Eligibility Traces
Lecture 41 - Eligibility Trace Control
Lecture 42 - Thompson Sampling Recap
Lecture 43 - Function Approximation
Lecture 44 - Linear Parameterization
Lecture 45 - State Aggregation Methods
Lecture 46 - Function Approximation and Eligibility Traces
Lecture 47 - LSTD and LSTDQ
Lecture 48 - LSPI and Fitted Q
Lecture 49 - DQN and Fitted Q-Iteration
Lecture 50 - Policy Gradient Approach
Lecture 51 - Actor Critic and REINFORCE
Lecture 52 - REINFORCE (cont'd)
Lecture 53 - Policy Gradient with Function Approximation
Lecture 54 - Hierarchical Reinforcement Learning
Lecture 55 - Types of Optimality
Lecture 56 - Semi Markov Decision Processes
Lecture 57 - Options
Lecture 58 - Learning with Options
Lecture 59 - Hierarchical Abstract Machines
Lecture 60 - MAXQ
Lecture 61 - MAXQ Value Function Decomposition
Lecture 62 - Option Discovery
Lecture 63 - POMDP Introduction
Lecture 64 - Solving POMDP
```

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NPTEL Video Course - Computer Science and Engineering - NOC:Introduction to Operating Systems

Subject Co-ordinator - Prof. Chester Rebeiro

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Intro to the Course
Lecture 2 - Introduction to OS
Lecture 3 - PC Hardware
Lecture 4 - From Programs to Processes
Lecture 5 - Sharing the CPU
Lecture 6 - Introduction
Lecture 7 - Virtual Memory
Lecture 8 - MMU Mapping
Lecture 9 - Segmentation
Lecture 10 - Memory Management in xv6
Lecture 11 - PC Booting
Lecture 12 - Week 3 Introduction
Lecture 13 - Create Execute and Exit from Processes
Lecture 14 - System Calls for Process Management
Lecture 15 - Interrupts
Lecture 16 - Interrupt Handling
Lecture 17 - Software Interrupts and System calls
Lecture 18 - CPU Context switching
Lecture 19 - CPU Scheduling
Lecture 20 - Priority Based Scheduling Algorithms
Lecture 21 - Multi-Processor Scheduling
Lecture 22 - Scheduling in Linux
Lecture 23 - Completely Fair Scheduling
Lecture 24 - Inter Process Communication
Lecture 25 - Synchronization
Lecture 26 - Software solutions for critical sections
Lecture 27 - Bakery Algorithm
Lecture 28 - Hardware Locks
Lecture 29 - Mutexes

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```
Lecture 30 - Semaphores
Lecture 31 - Dining Philosophers Problem
Lecture 32 - Deadlocks
Lecture 33 - Dealing with Deadlocks
Lecture 34 - Threads - Part 1
Lecture 35 - Threads - Part 2
Lecture 36 - Operating system security
Lecture 37 - Information Flow policies
Lecture 38 - Buffer Overflows
Lecture 39 - Preventing Buffer Overflow Attacks
```

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NPTEL Video Course - Computer Science and Engineering - NOC:Programming, Data Structures and Algorithms in Py

Subject Co-ordinator - Prof. Madhavan Mukund

Co-ordinating Institute - Chennai Mathematical Institute

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable


```
Lecture 1  - Lecture 1 - Algorithms and programming
Lecture 2  - Lecture 2 - Improving naive gcd
Lecture 3  - Lecture 3 - Euclid's algorithm for gcd
Lecture 4  - Lecture 4 - Downloading and installing Python
Lecture 5  - Lecture 1 - Assignment statement, basic types - int, float, bool
Lecture 6  - Lecture 2 - Strings
Lecture 7  - Lecture 3 - Lists
Lecture 8  - Lecture 4 - Control Flow
Lecture 9  - Lecture 5 - Functions
Lecture 10 - Lecture 6 - Examples
Lecture 11 - Lecture 1 - More about range()
Lecture 12 - Lecture 2 - Manipulating lists
Lecture 13 - Lecture 3 - Breaking out of a loop
Lecture 14 - Lecture 4 - Arrays vs lists, binary search
Lecture 15 - Lecture 5 - Efficiency
Lecture 16 - Lecture 6 - Selection Sort
Lecture 17 - Lecture 7 - Insertion Sort
Lecture 18 - Lecture 8 - Recursion
Lecture 19 - Lecture 1 - Mergesort
Lecture 20 - Lecture 2 - Mergesort, analysis
Lecture 21 - Lecture 3 - Quicksort
Lecture 22 - Lecture 4 - Quicksort analysis
Lecture 23 - Lecture 5 - Tuples and dictionaries
Lecture 24 - Lecture 6 - Function definitions
Lecture 25 - Lecture 7 - List Comprehension
Lecture 26 - Lecture 1 - Exception Handling
Lecture 27 - Lecture 2 - Standard input and output
Lecture 28 - Lecture 3 - Handling files
Lecture 29 - Lecture 4 - String functions
```

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```
Lecture 30 - Lecture 5 - Formatting printed output
Lecture 31 - Lecture 6 - pass, del() and None
Lecture 32 - Lecture 1 - Backtracking, N queens
Lecture 33 - Lecture 2 - Global scope, nested functions
Lecture 34 - Lecture 3 - Generating permutations
Lecture 35 - Lecture 4 - Sets, stacks, queues
Lecture 36 - Lecture 5 - Priority queues and heaps
Lecture 37 - Lecture 1 - Abstract datatypes, classes and objects
Lecture 38 - Lecture 2 - Classes and objects in Python
Lecture 39 - Lecture 3 - User defined lists
Lecture 40 - Lecture 4 - Search trees
Lecture 41 - Lecture 1 - Memoization and dynamic programming
Lecture 42 - Lecture 2 - Grid paths
Lecture 43 - Lecture 3 - Longest common subsequence
Lecture 44 - Lecture 4 - Matrix multiplication
Lecture 45 - Lecture 5 - Wrap-up, Python vs other languages
```

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NPTEL Video Course - Computer Science and Engineering - NOC:Privacy and Security in Online Social Networks

Subject Co-ordinator - Prof. Ponnurangam Kumaraguru

Co-ordinating Institute - IIITD

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable


```
Lecture 1 - Intro to Course
Lecture 2 - Intro to Course
Lecture 3 - Incidents
Lecture 4 - Tutorial 1 - Part 1 Ubuntu
Lecture 5 - Tutorial 1 - Part 2 Python
Lecture 6 - OSM APIs and tools for data collection
Lecture 7 - Tutorial 2 - Part 1 Facebook API
Lecture 8 - Tutorial 2 - Part 2 Facebook API
Lecture 9 - Trust and Credibility on OSM
Lecture 10 - Misinformation on Social Media
Lecture 11 - Privacy and Social Media
Lecture 12 - Tutorial 3 - Part 1 Twitter API
Lecture 13 - Tutorial 3 - Part 2 MySQL
Lecture 14 - Tutorial 3 - Part 3 MongoDB
Lecture 15 - Privacy and Pictures on Online Social Media
Lecture 16 - Policing and Online Social Media
Lecture 17 - Policing and Online Social Media
Lecture 18 - Policing and Online Social Media
Lecture 19 - eCrime on Online Social Media
Lecture 20 - eCrime on Online Social Media
Lecture 21 - Tutorial 4 - Social Network Analysis
Lecture 22 - Link Farming in Online Social Media
Lecture 23 - Nudges
Lecture 24 - Semantic attacks
Lecture 25 - Tutorial 5 - Analyzing text using Python NLTK
Lecture 26 - Profile Linking on Online Social Media
Lecture 27 - Anonymous Networks
Lecture 28 - Tutorial 6 - Gephi Network Visualization
Lecture 29 - Privacy in Location Based Social Networks - Part 1
```

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Lecture 30 - Privacy in Location Based Social Networks - Part 2
Lecture 31 - Tutorial 7 - Visualization - Highcharts
Lecture 32 - Beware of What You Share Inferring Home Location in Social Networks
Lecture 33 - On the dynamics of username change behavior on Twitter
Lecture 34 - Boston Marathon Analyzing Fake Content on Twitter

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NPTEL Video Course - Computer Science and Engineering - NOC:Mobile Computing

Subject Co-ordinator - Prof. Pushpendra Singh

Co-ordinating Institute - IIITD

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Java Basics
Lecture 2 - Java
Lecture 3 - Java
Lecture 4 - Java
Lecture 5 - Java
Lecture 6 - Introduction to Android Studio
Lecture 7 - Your First App
Lecture 8 - Deploying your App to a Phone
Lecture 9 - Extending app - Buttons, Toast
Lecture 10 - Android Development Environment
Lecture 11 - User Interface
Lecture 12 - Application Fundamentals
Lecture 13 - Extending the application
Lecture 14 - Activity Lifecycle - I
Lecture 15 - Activity Lifecycle - II
Lecture 16 - Activity LifeCycle - III
Lecture 17 - Adding Icon, Layouts, Handling Rotation - I
Lecture 18 - Adding Icon, Layouts, Handling Rotation - II
Lecture 19 - Debugging
Lecture 20 - Intents - I
Lecture 21 - Intents - II
Lecture 22 - Observer Pattern
Lecture 23 - Fragments - I
Lecture 24 - Fragments - II
Lecture 25 - Fragment Basic Programming Example
Lecture 26 - Fragments - Advanced Example
Lecture 27 - Implicit Intents
Lecture 28 - Saving Data - I
Lecture 29 - Saving Data - II

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```
Lecture 30 - Security and System Permissions
Lecture 31 - Services
Lecture 32 - Processes and threads
Lecture 33 - Working with Fragments - I
Lecture 34 - Working with Fragments - II
Lecture 35 - Working with Fragments - III
Lecture 36 - RecyclerView, Adapter
Lecture 37 - RecyclerView, Adapter, ViewHolder
Lecture 38 - ViewPager
Lecture 39 - Dialogues
```

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NPTEL Video Course - Computer Science and Engineering - NOC:Introduction to Modern Application Development

Subject Co-ordinator - Tanmai Gopal, Prof. Gaurav Raina

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to the course
Lecture 2 - Introduction to a web-app
Lecture 3 - Building a web-app
Lecture 4 - Networks
Lecture 5 - Practical - Running your own web-server
Lecture 6 - Protocols
Lecture 7 - Practical - SSH + Network experiments
Lecture 8 - Practical - Building a webapp with nodejs and using git. Introduction to reverse proxies.
Lecture 9 - Practical - Introduciton to server-side javascript and HTML/CSS
Lecture 10 - Introduction to client-side Javascript
Lecture 11 - Practical - APIs and mobile apps use web-servers
Lecture 12 - Introduction to databases
Lecture 13 - Data modelling and constraints
Lecture 14 - Interacting with a DBMS
Lecture 15 - Practical - Deeper exploration of a DBMS (column types and more)
Lecture 16 - Introduction to SQL
Lecture 17 - Understanding database performance
Lecture 18 - Transactions and ACID properties
Lecture 19 - Database security, backup and recovery
Lecture 20 - Analytics and Views
Lecture 21 - Scaling a database
Lecture 22 - Connecting your webapp to your database and SQL Injection
Lecture 23 - SQL and NoSQL systems
Lecture 24 - Authentication with HTTP
Lecture 25 - Understanding security, and some best practices for webapps
Lecture 26 - Introduction to authentication, hashing, curl and sessions
Lecture 27 - Introduction to mobile apps
Lecture 28 - Introduction to Mobile Application Development Part 2
Lecture 29 - Introduction to Android

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```
Lecture 30 - Getting started with Android Application Development
Lecture 31 - Building Custom UI using XML and Logs
Lecture 32 - Building a Blog App
Lecture 33 - Deploying an app to the Google Play Store
Lecture 34 - Introduction to iOS
Lecture 35 - The API Economy
```

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NPTEL Video Course - Computer Science and Engineering - NOC:Information Security-3

Subject Co-ordinator - Prof. V. Kamakoti

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Operating System Introduction
Lecture 2 - Storage Hierarchy, Exceptions, Interrupts and traps
Lecture 3 - OS Management Services
Lecture 4 - OS Security Issues
Lecture 5 - Process and Threads
Lecture 6 - Process Scheduling
Lecture 7 - Scheduling Algorithm
Lecture 8 - Process Synchronization
Lecture 9 - Memory Management - 1
Lecture 10 - Memory Management - 2
Lecture 11 - File Systems - 1
Lecture 12 - File Systems - 2
Lecture 13 - Unix Filesystem
Lecture 14 - Unix Filesystem (Continued...)
Lecture 15 - Linux
Lecture 16 - Linux
Lecture 17 - Linux
Lecture 18 - Linux
Lecture 19 - Linux
Lecture 20 - Linux
Lecture 21 - Linux
Lecture 22 - Linux
Lecture 23 - Linux
Lecture 24 - Linux
Lecture 25 - Basic Networking Administration
Lecture 26 - Filesystems and Devices
Lecture 27 - Shell Introduction
Lecture 28 - Shell Comments and Variables
Lecture 29 - Shell Variables

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```
Lecture 30 - Shell Arrays and Arithmetic
Lecture 31 - Shell Condition and Relation
Lecture 32 - Shell Examples
Lecture 33 - Shell Functions
Lecture 34 - Shell File Test
Lecture 35 - Shell Loop Control
Lecture 36 - Shell Script Variations
Lecture 37 - Shell Pattern Matching
Lecture 38 - Shell Case Statements
Lecture 39 - Shell Co-routines
Lecture 40 - Shell Signals and Traps
Lecture 41 - Shell Subshell
Lecture 42 - Shell Declarations
Lecture 43 - Shell Examples 2
Lecture 44 - Shell Review
Lecture 45 - An Introduction
Lecture 46 - Structure of a Network
Lecture 47 - Network Core - Definition
Lecture 48 - Network Access and Physical Media
Lecture 49 - Structure of ISP and Packet Delays
Lecture 50 - Network Protocol Layers
Lecture 51 - Network Devices
Lecture 52 - Network Security - An Introduction
Lecture 53 - Public Key Cryptography
Lecture 54 - Digital Signatures
Lecture 55 - Security in Practise
Lecture 56 - Security in Practise (Continued...)
Lecture 57 - Wireshark
Lecture 58 - Snort
Lecture 59 - Review I
Lecture 60 - Review II
```

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NPTEL Video Course - Computer Science and Engineering - NOC:AI:Constraint Satisfaction

Subject Co-ordinator - Prof. Deepak Khemani

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable │ MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Constraint Satisfaction Problems
Lecture 2 - CSP Examples: Map colouring, N-Queens, Classroom scheduling
Lecture 3 - CSP Examples: Huffman-Clowes Labelling, Waltz Algorithm, Crosswords
Lecture 4 - Model Based Diagnosis - An application of CSP
Lecture 5 - Constraint Networks - An Introduction
Lecture 6 - Binary Constraint Networks (BCN), Equivalent Networks
Lecture 7 - Projection Networks
Lecture 8 - Constraint Propagation
Lecture 9 - Algorithms AC1 and AC3
Lecture 10 - Can we do better than AC3?
Lecture 11 - Algorithm AC4
Lecture 12 - Generalized AC, Path-Consistency
Lecture 13 - i-Consistency, Algorithm PC1
Lecture 14 - Algorithm PC2, Strong i-Consistency
Lecture 15 - Directional Consistency and Graph Ordering
Lecture 16 - Min-Width and Min-Induced-Width Ordering
Lecture 17 - Directional Arc-Consistency and Tree CSPs
Lecture 18 - Directional Path-Consistency and Directional i-Consistency
Lecture 19 - Backtrack-Free search and Adaptive Consistency
Lecture 20 - Adaptive Consistency: Bucket Elimination
Lecture 21 - Search Methods for Solving CSPs
Lecture 22 - Algorithm Backtracking
Lecture 23 - Look-Ahead Methods in Search
Lecture 24 - Look-Ahead Search: Examples
Lecture 25 - Combining Search with Reasoning: Algorithm DPLL
Lecture 26 - Algorithm Backmarking
Lecture 27 - Dynamic Value Ordering, Dynamic Variable Ordering
Lecture 28 - Look-Back Methods - Definitions
Lecture 29 - GaschnigÂ s Backjumping: The Culprit Variable

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```
Lecture 30 - GaschnigÂ s Backjumping, Graph-Based Backjumping
Lecture 31 - Graph-Based Backjumping: Internal and Relevant Dead-Ends
Lecture 32 - Conflict-Directed Backjumping: Definitions
Lecture 33 - Algorithm Conflict-Directed Backjumping
Lecture 34 - Combining Look-Ahead and Look-Back: FC-CBJ
Lecture 35 - Learning During Search
Lecture 36 - Model Based Systems
Lecture 37 - Model Based Diagnosis
Lecture 38 - Truth Maintenance Systems
Lecture 39 - Planning as Constraint Satisfaction
Lecture 40 - Planning as Constraint Satisfaction (Continued...)
Lecture 41 - Planning as Satisfiability
Lecture 42 - Wrapping Up and Further Study
```

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NPTEL Video Course - Computer Science and Engineering - NOC:Computer Organization

Subject Co-ordinator - Prof. V. Kamakoti

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction High Speed Circuit - Design Recursive Doubling
Lecture 2 - High Speed Circuit Design - Fast Adder Circuits
Lecture 3 - Lab 1
Lecture 4 - Fast Adder Circuits (Continued...)
Lecture 5 - Fast Multiplier Circuit
Lecture 6 - Fast Multiplier Circuit (Continued...)
Lecture 7 - Programming using X86 ISA - Addressing Modes
Lecture 8 - Programming using X86 ISA - Addressing Modes
Lecture 9 - Floating point - Precision and Accuracy
Lecture 10 - Floating Point - Addition, Subtraction and Multiplication
Lecture 11 - Instruction Set Architecture
Lecture 12 - Instruction Set Architecture (Continued...)
Lecture 13 - Lab 2
Lecture 14 - Lab 2
Lecture 15 - Lab 2
Lecture 16 - Orthogonal ISA, C Constructs Mapping, Addressing Modes
Lecture 17 - Atomic and Predicated Instructions
Lecture 18 - Atomic and Predicated Instructions (Continued...)
Lecture 19 - General Purpose Registers
Lecture 20 - Expanding opcodes
Lecture 21 - Introduction to Pipelining
Lecture 22 - Pipelining
Lecture 23 - Data Hazards
Lecture 24 - Lab 2
Lecture 25 - Dynamic Instruction Scheduling
Lecture 26 - Dynamic Instruction Scheduling (Continued...)
Lecture 27 - Control Hazard, Branch Prediction
Lecture 28 - Process Management
Lecture 29 - Branch prediction

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```
Lecture 30 - Global Branch Prediction
Lecture 31 - Structural Hazard, Architectural Enhancements
Lecture 32 - Lab 3
Lecture 33 - Locality of Reference, Demand paging
Lecture 34 - Page Replacement Algorithm
Lecture 35 - Multilevel Paging, Translational Lookaside Buffer
Lecture 36 - Multilevel Paging
Lecture 37 - Multilevel Paging - Part 1
Lecture 38 - Page Frame Allocation, Beledy's Anomaly
Lecture 39 - Paging, Cache
Lecture 40 - Cache
Lecture 41 - Cache Organisation
Lecture 42 - Cache - Cache Coherency, Dual Ported Cache
Lecture 43 - Multilevel Caching, Multitasking
Lecture 44 - Cache, Degree of Multiprogramming
Lecture 45 - Shared Memory Architecture
Lecture 46 - Shared Memory Architecture - Part I
Lecture 47 - Virtually Indexed - Virtually Tagged and Physically Tagged Caches
Lecture 48 - Lab 4
Lecture 49 - Shared Memory Architecture, Cache Coherence
Lecture 50 - Concurrent Programming in Hardware - Part I
Lecture 51 - Concurrent Programming in Hardware - Part II
Lecture 52 - Conclusion
```

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NPTEL Video Course - Computer Science and Engineering - NOC:Introduction to Wireless and Cellular Communicati

Subject Co-ordinator - Prof. David Kovil Pillai

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Overview of Cellular Systems - Part 1
Lecture 2 - Overview of Cellular Systems - Part 2
Lecture 3 - Overview of Cellular Systems - Part 3
Lecture 4 - 5G and other Wireless Technologies
Lecture 5 - Basic Cellular Terminology
Lecture 6 - Introduction to Antennas and Propagation Models
Lecture 7 - Link budget, Fading margin, Outage
Lecture 8 - Cellular Concept
Lecture 9 - Cellular system design and analysis
Lecture 10 - Cellular Geometry and System Design
Lecture 11 - Cellular System Capacity, Trunking
Lecture 12 - Handoff and Mobility
Lecture 13 - Handoff Part 2, Classification of Signal Variation
Lecture 14 - Shadowing, Outage, Multipath
Lecture 15 - Rayleigh Fading and Statistical Characterization
Lecture 16 - Properties of Rayleigh Distribution
Lecture 17 - BER in Fading, Narrowband vs Wideband Channels
Lecture 18 - Characterization of Multipath Fading Channels
Lecture 19 - Choice of Modulation
Lecture 20 - Coherent versus Differential Detection
Lecture 21 - Review of Lecture 1-19
Lecture 22 - Coherent vs Differential Detection - Part II and BER in Fading
Lecture 23 - BER in Fading - Part II, Ricean Fading
Lecture 24 - Ricean and Nakagami Fading, Moment Generating Function (MGF)
Lecture 25 - MGF Part II, WSSUS Model
Lecture 26 - WSSUS Part II, Coherence Time, Doppler Spectrum
Lecture 27 - Doppler, Temporal Characteristics of Fading Channels
Lecture 28 - WSSUS-Characterization of Time Dispersive Fading Channels
Lecture 29 - WSSUS-Classification of Fading Channels

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Lecture 30 - Practical Channel Models (ITU, COST), Computer generation of Rayleigh fading
Lecture 31 - Rayleigh Fading simulation - Clark and Gans Method, Jakesâ   Method
Lecture 32 - Jakesâ   Method   properties
Lecture 33 - Introduction to Diversity, Antenna selection diversity
Lecture 34 - Statistical Characterization of Antenna Diversity, Optimal Diversity Combining
Lecture 35 - BER in fading, Equal Gain Combining
Lecture 36 - Array Gain, Diversity Gain, Alamouti Scheme
Lecture 37 - Alamouti Scheme - Part II, Channel Capacity
Lecture 38 - Capacity of fading Channels, Capacity with Outage
Lecture 39 - Channel State Information, Optimum Power Allocation
Lecture 40
Lecture 41
Lecture 42
Lecture 43
Lecture 44
Lecture 45
Lecture 46 - (Missing)
Lecture 47 - (Missing)
Lecture 48 - Rake Receiver for multipath channels
Lecture 49 - Multiuser environment
Lecture 50 - CDMA system Capacity
Lecture 51 - CDMA Multiuser Detectors - Part 1
Lecture 52 - CDMA Multiuser Detectors - Part 2
Lecture 53
Lecture 54
Lecture 55
Lecture 56
```

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NPTEL Video Course - Computer Science and Engineering - NOC:Distributed Systems

Subject Co-ordinator - Dr. Rajiv Misra

Co-ordinating Institute - IIT - Patna

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to Distributed Systems
Lecture 2 - Basic Algorithms in Message Passing System
Lecture 3 - Leader Election in Rings
Lecture 4 - Distributed Models of Computation, Causality and Logical Time
Lecture 5 - Size of Vector Clock, Matrix Clocks, Virtual Time and Physical Clock Synchronization
Lecture 6 - Global State and Snapshot Recording Algorithms
Lecture 7 - Distributed Mutual Exclusion and Non-Token based Approaches
Lecture 8 - Quorum Based Distributed Mutual Exclusion Approaches
Lecture 9 - Token Based Distributed Mutual Exclusion Approaches
Lecture 10 - Consensus and Agreement Algorithms
Lecture 11 - Checkpointing and Rollback Recovery
Lecture 12 - Deadlock Detection in Distributed Systems
Lecture 13 - Distributed Shared Memory
Lecture 14 - Distributed Minimum Spanning Tree
Lecture 15 - Termination Detection in Distributed System
Lecture 16 - Message Ordering and Group Communication
Lecture 17 - Self-Stabilization
Lecture 18 - Case Study 1 - Distributed Randomized Algorithms
Lecture 19 - Case Study 2 - Peer-to-Peer Computing and Structured Overlay Network
Lecture 20 - Case Study 3 - The Google File System (GFS)
Lecture 21 - Case Study 4 - MapReduce
Lecture 22 - Case Study 5 - HDFS
Lecture 23 - Case Study 6 - Spark
Lecture 24 - Case Study 7 - Distributed Algorithms for Sensor Networks
Lecture 25 - Case Study 8 - Authentication in Distributed Systems
Lecture 26 - Case Study 9 - Bitcoin
Lecture 27 - Case Study 10 - BlockChain Technology

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NPTEL Video Course - Computer Science and Engineering - NOC:Social Networks

Subject Co-ordinator - Prof. Sudarshan Iyengar

Co-ordinating Institute - IIT - Ropar

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction
Lecture 2 - Answer to the puzzle
Lecture 3 - Introduction to Python - 1
Lecture 4 - Introduction to Python - 2
Lecture 5 - Introduction to Networkx - 1
Lecture 6 - Introduction to Networkx - 2
Lecture 7 - Social Networks
Lecture 8 - Google Page Rank
Lecture 9 - Searching in a Network
Lecture 10 - Link Prediction
Lecture 11 - The Contagions
Lecture 12 - Importance of Acquaintances
Lecture 13 - Marketing on Social Networks
Lecture 14 - Introduction to Datasets
Lecture 15 - Ingredients Network
Lecture 16 - Synonymy Network
Lecture 17 - Web Graph
Lecture 18 - Social Network Datasets
Lecture 19 - Datasets
Lecture 20 - Datasets
Lecture 21 - Datasets
Lecture 22 - Datasets
Lecture 23 - Introduction
Lecture 24 - Advanced Material
Lecture 25 - Programming Illustration
Lecture 26 - Summary to Datasets
Lecture 27 - Introduction
Lecture 28 - Granovetter's Strength of weak ties
Lecture 29 - Triads, clustering coefficient and neighborhood overlap

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Lecture 30 - Structure of weak ties, bridges, and local bridges
Lecture 31 - Validation of Granovetter's experiment using cell phone data
Lecture 32 - Embededness
Lecture 33 - Structural Holes
Lecture 34 - Social Capital
Lecture 35 - Finding Communities in a graph (Brute Force Method)
Lecture 36 - Community Detection Using Girvan Newman Algorithm
Lecture 37 - Visualising Communities using Gephi
Lecture 38 - Tie Strength, Social Media and Passive Engagement
Lecture 39 - Betweenness Measures and Graph Partitioning
Lecture 40 - Strong and Weak Relationship - Summary
Lecture 41 - Introduction to Homophily - Should you watch your company ?
Lecture 42 - Selection and Social Influence
Lecture 43 - Interplay between Selection and Social Influence
Lecture 44 - Homophily - Definition and measurement
Lecture 45 - Foci Closure and Membership Closure
Lecture 46 - Introduction to Fatman Evolutionary model
Lecture 47 - Fatman Evolutionary Model - The Base Code (Adding people)
Lecture 48 - Fatman Evolutionary Model - The Base Code (Adding Social Foci)
Lecture 49 - Fatman Evolutionary Model - Implementing Homophily
Lecture 50 - Quantifying the Effect of Triadic Closure
Lecture 51 - Fatman Evolutionary Model - Implementing Closures
Lecture 52 - Fatman Evolutionary Model - Implementing Social Influence
Lecture 53 - Fatman Evolutionary Model - Storing and analyzing longitudnal data
Lecture 54 - Spatial Segregation
Lecture 55 - Spatial Segregation
Lecture 56 - Spatial Segregation
Lecture 57 - Schelling Model Implementation - 1 (Introduction)
Lecture 58 - Schelling Model Implementation - 2 (Base Code)
Lecture 59 - Schelling Model Implementation - 3 (Visualization and Getting a list of boundary and internal no
Lecture 60 - Schelling Model Implementation - 4 (Getting a list of unsatisfied nodes)
Lecture 61 - Schelling Model Implementation - 5 (Shifting the unsatisfied nodes and visualizing the final gra
Lecture 62 - Chapter - 5 Positive and Negative Relationships (Introduction)
Lecture 63 - Structural Balance
Lecture 64 - Enemy'S Enemy is a Friend
Lecture 65 - Characterizing the Structure of Balanced Networks
Lecture 66 - Balance Theorem
Lecture 67 - Proof of Balance Theorem
Lecture 68 - Introduction to positive and negative edges
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Lecture 69 - Outline of implemantation
Lecture 70 - Creating graph, displaying it and counting unstable triangles
Lecture 71 - Moving a network from an unstable to stable state
Lecture 72 - Forming two coalitions
Lecture 73 - Forming two coalitions (Continued...)
Lecture 74 - Visualizing coalitions and the evolution
Lecture 75 - The Web Graph
Lecture 76 - Collecting the Web Graph
Lecture 77 - Equal Coin Distribution
Lecture 78 - Random Coin Dropping
Lecture 79 - Google Page Ranking Using Web Graph
Lecture 80 - Implementing PageRank Using Points Distribution Method - 1
Lecture 81 - Implementing PageRank Using Points Distribution Method - 2
Lecture 82 - Implementing PageRank Using Points Distribution Method - 3
Lecture 83 - Implementing PageRank Using Points Distribution Method - 4
Lecture 84 - Implementing PageRank Using Random Walk Method - 1
Lecture 85 - Implementing PageRank Using Random Walk Method - 2
Lecture 86 - DegreeRank versus PageRank
Lecture 87 - We Follow
Lecture 88 - Why do we Follow?
Lecture 89 - Diffusion in Networks
Lecture 90 - Modeling Diffusion
Lecture 91 - Modeling Diffusion (Continued...)
Lecture 92 - Impact of Commmunities on Diffusion
Lecture 93 - Cascade and Clusters
Lecture 94 - Knowledge, Thresholds and the Collective Action
Lecture 95 - An Introduction to the Programming Screencast (Coding 4 major ideas)
Lecture 96 - The Base Code
Lecture 97 - Coding the First Big Idea - Increasing the Payoff
Lecture 98 - Coding the Second Big Idea - Key People
Lecture 99 - Coding the Third Big Idea - Impact of Communities on Cascades
Lecture 100 - Coding the Fourth Big Idea - Cascades and Clusters
Lecture 101 - Introduction to Hubs and Authorities (A Story)
Lecture 102 - Principle of Repeated Improvement (A story)
Lecture 103 - Principle of Repeated Improvement (An example)
Lecture 104 - Hubs and Authorities
Lecture 105 - PageRank Revisited - An example
Lecture 106 - PageRank Revisited - Convergence in the Example
Lecture 107 - PageRank Revisited - Conservation and Convergence
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Lecture 108 - PageRank, conservation and convergence - Another example
Lecture 109 - Matrix Multiplication (Pre-requisite 1)
Lecture 110 - Convergence in Repeated Matrix Multiplication (Pre-requisite 1)
Lecture 111 - Addition of Two Vectors (Pre-requisite 2)
Lecture 112 - Convergence in Repeated Matrix Multiplication- The Details
Lecture 113 - PageRank as a Matrix Operation
Lecture 114 - PageRank Explained
Lecture 115 - Introduction to Powerlaw
Lecture 116 - Why do Normal Distributions Appear?
Lecture 117 - Power Law emerges in WWW graphs
Lecture 118 - Detecting the Presence of Powerlaw
Lecture 119 - Rich Get Richer Phenomenon
Lecture 120 - Summary So Far
Lecture 121 - Implementing Rich-getting-richer Phenomenon (Barabasi-Albert Model) - 1
Lecture 122 - Implementing Rich-getting-richer Phenomenon (Barabasi-Albert Model) - 2
Lecture 123 - Implementing a Random Graph (Erdos-Renyi Model) - 1
Lecture 124 - Implementing a Random Graph (Erdos-Renyi Model) - 2
Lecture 125 - Forced Versus Random Removal of Nodes (Attack Survivability)
Lecture 126 - Rich Get Richer - A Possible Reason
Lecture 127 - Rich Get Richer - The Long Tail
Lecture 128 - Epidemics- An Introduction
Lecture 129 - Introduction to epidemics (Continued...)
Lecture 130 - Simple Branching Process for Modeling Epidemics
Lecture 131 - Simple Branching Process for Modeling Epidemics (Continued...)
Lecture 132 - Basic Reproductive Number
Lecture 133 - Modeling epidemics on complex networks
Lecture 134 - SIR and SIS spreading models
Lecture 135 - Comparison between SIR and SIS spreading models
Lecture 136 - Basic Reproductive Number Revisited for Complex Networks
Lecture 137 - Percolation model
Lecture 138 - Analysis of basic reproductive number in branching model (The problem statement)
Lecture 139 - Analyzing basic reproductive number - 2
Lecture 140 - Analyzing basic reproductive number - 3
Lecture 141 - Analyzing basic reproductive number - 4
Lecture 142 - Analyzing basic reproductive number - 5
Lecture 143 - Small World Effect - An Introduction
Lecture 144 - Milgram's Experiment
Lecture 145 - The Reason
Lecture 146 - The Generative Model

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Lecture 147 - Decentralized Search - I
Lecture 148 - Decentralized Search - II
Lecture 149 - Decentralized Search - III
Lecture 150 - Programming illustration- Small world networks
Lecture 151 - Base code
Lecture 152 - Making homophily based edges
Lecture 153 - Adding weak ties
Lecture 154 - Plotting change in diameter
Lecture 155 - Programming illustration- Myopic Search
Lecture 156 - Myopic Search
Lecture 157 - Myopic Search comparision to optimal search
Lecture 158 - Time Taken by Myopic Search
Lecture 159 - PseudoCores
Lecture 160 - How to be Viral
Lecture 161 - Who are the right key nodes?
Lecture 162 - finding the right key nodes (the core)
Lecture 163 - Coding K-Shell Decomposition
Lecture 164 - Coding cascading Model
Lecture 165 - Coding the importance of core nodes in cascading
Lecture 166 - Pseudo core

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NPTEL Video Course - Computer Science and Engineering - NOC:An Introduction to Probability in Computing

Subject Co-ordinator - Prof. John Augustine

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to Probability - A box of chocolates
Lecture 2 - Introduction to Probability - Axiomatic Approach to Probability Theory
Lecture 3 - Introduction to Probability - Verifying Matrix Multipilication (Statement,Algorithm and Independe
Lecture 4 - Introduction to Probability - Verifying Matrix Multipilication (Correctness and Law of Total Prok
Lecture 5 - Introduction to Probability - How Strong is your Network?
Lecture 6 - Introduction to Probability - How to Understand the World? Play with it!
Lecture 7 - Tutorial 1
Lecture 8 - Tutorial 2
Lecture 9 - Discrete Random Variables - Basic Definitions
Lecture 10 - Discrete Random Variables - Linearity of Expectation and Jensens Inequality
Lecture 11 - Discrete Random Variables - Conditional Expectation I
Lecture 12 - Discrete Random Variables - Conditional Expectation II
Lecture 13 - Discrete Random Variables - Geometric Random Variables and Collecting Coupons
Lecture 14 - Discrete Random Variables - Randomized Selection
Lecture 15 - Tail Bounds I - Markov's Inequality
Lecture 16 - Tail Bounds I - The Second Moment,Variance and Chebyshev's Inequality
Lecture 17 - Tail Bounds I - Median via Sampling
Lecture 18 - Tail Bounds I - Median via Sampling - Analysis
Lecture 19 - Tail Bounds I - Moment Generating Functions and Chernoff Bounds
Lecture 20 - Tail Bounds I - Parameter Estimation
Lecture 21 - Tail Bounds I - Control Group Selection
Lecture 22 - Applications of Tail Bounds - Routing in Sparse Networks
Lecture 23 - Applications of Tail Bounds - Analysis of Valiant's Rounting
Lecture 24 - Applications of Tail Bounds - Random Graphs
Lecture 25 - Live Session 2
Lecture 26 - Live Session

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NPTEL Video Course - Computer Science and Engineering - NOC:Introduction to Human Computer Interaction

Subject Co-ordinator - Prof. Ponnurangam Kumaraguru

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to Human Computer Interaction
Lecture 2 - What is HCI? Commonalities and Differences in Interfaces
Lecture 3 - Door handle, Elevators, Contextual Inquiry, Affinity Diagrams
Lecture 4 - Lab Session Contextual Inquiry
Lecture 5 - Lab Session Affinity Diagram
Lecture 6 - Tutorial on Photoshop
Lecture 7 - Tutorial on UI Designing using Photoshop
Lecture 8 - Institutional Review Board, Ethics committee, IRB documents / application, consent form
Lecture 9 - Tutorial on Proto.io
Lecture 10 - Tutorial on Lookback
Lecture 11 - How to understand user needs? Surveys, Questionnaire
Lecture 12 - How to understand user needs? Surveys, Questionnaire - Continues
Lecture 13 - Prototyping
Lecture 14 - User-Centered Design
Lecture 15 - Lab Session
Lecture 16 - Design Patterns
Lecture 17 - Lab Session
Lecture 18 - Usable security
Lecture 19 - Lab Session
Lecture 20 - Continuity of Usable Security
Lecture 21 - Visual Design
Lecture 22 - Visual Design - 2
Lecture 23 - Crypto price Tracker App
Lecture 24 - Interacto
Lecture 25 - Tech Hinder
Lecture 26 - busKARO
Lecture 27 - MayMayMe
Lecture 28 - noWhinge

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NPTEL Video Course - Computer Science and Engineering - NOC:Information Security-IV

Subject Co-ordinator - Prof.M J Shankar Raman, Prof. V. Kamakoti, Prof.Vasan

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - WISE Gen and The IT Revolution - 1
Lecture 2 - WISE Gen and The IT Revolution - 1 (Continued...)
Lecture 3 - WISE GEN - Next Step
Lecture 4 - Network Security
Lecture 5 - Symmetric Key Cryptography and Digital Signatures
Lecture 6 - Basic Network Security Components
Lecture 7 - Internet Security Threats
Lecture 8 - History of Kali Linux
Lecture 9 - Penetration Testing with Kali Linux
Lecture 10 - Network Security and Forensics Introduction - I
Lecture 11 - Network Security and Forensics Introduction - II
Lecture 12 - Penetration Testing
Lecture 13 - Penetration testing steps in Kali Linux
Lecture 14 - Kali Linux Installation
Lecture 15 - Reconnaissance - Part I
Lecture 16 - Reconnaissance - Part II
Lecture 17 - Serverside Attacks
Lecture 18 - Serverside Attacks
Lecture 19 - Serverside Attacks
Lecture 20 - Serverside Attacks
Lecture 21 - Serverside Attacks
Lecture 22 - Serverside Attacks
Lecture 23 - Client Side Attacks - Tools in Kali Linux - 1
Lecture 24 - Client Side Attacks - Tools in Kali Linux - 2
Lecture 25 - Client Side Attacks - Tools in Kali Linux - 3
Lecture 26 - Client Side Attacks - Tools in Kali Linux - 4
Lecture 27 - Authentication Based Attacks - Tools in Kali Linux - 1
Lecture 28 - Authentication Based Attacks - Tools in Kali Linux - 2
Lecture 29 - Authentication Based Attacks - Tools in Kali Linux - 3

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Lecture 30 - Authentication Based Attacks - Tools in Kali Linux - 4
Lecture 31 - Authentication Based Attacks - Tools in Kali Linux - 5
Lecture 32 - Web Attacks - Tools in Kali Linux - 1
Lecture 33 - Web Attacks - Tools in Kali Linux - 2
Lecture 34 - Penetration Testing Attacks - Defensive Countermeasures
Lecture 35 - Technical Fundamentals for Evidence Acquisition - 1
Lecture 36 - Technical Fundamentals for Evidence Acquisition - 2
Lecture 37 - Packet Capture Tools and Methods
Lecture 38 - Wireshark Introduction
Lecture 39 - Packet Analysis
Lecture 40 - Flow Analysis
Lecture 41 - Case study 1
Lecture 42 - Case study 1 (Continued...)
Lecture 43 - Wireless Forensics - Technology
Lecture 44 - Wireless Network Security Framework
Lecture 45 - Wireless Access Points - Security issues
Lecture 46 - Case Study 2 - Use of tools
Lecture 47 - Network Security Devices - IDS
Lecture 48 - IDS Evidence Acquistion and SNORT
Lecture 49 - SNORT Rules
Lecture 50 - SNORT Installation
Lecture 51 - SNORT Configuration and Demonstration
Lecture 52 - Evidence collection in Switches and Routers
Lecture 53 - Evidence collection in Routers and Firewalls
Lecture 54 - IPTables rules and tool usage
Lecture 55 - Logs, Rules and Automated Tools
Lecture 56 - Re-cap of All Topics
Lecture 57 - Introduction to Meltdown Attack
Lecture 58 - Introduction to Meltdown - Address Space Basics
Lecture 59 - Meltdown Attack - Out of Order Execution
Lecture 60 - Meltdown Attack - Recovering from Exception
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NPTEL Video Course - Computer Science and Engineering - NOC:Data Science for Engineers

Subject Co-ordinator - Prof. Shankar Narasimhan, Prof. Ragunathan Rengasamy

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable │ MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Data science for engineers Course philosophy and expectation
Lecture 2 - Introduction to R
Lecture 3 - Introduction to R (Continued...)
Lecture 4 - Variables and datatypes in R
Lecture 5 - Data frames
Lecture 6 - Recasting and joining of dataframes
Lecture 7 - Arithmetic,Logical and Matrix operations in R
Lecture 8 - Advanced programming in R
Lecture 9 - Advanced Programming in R
Lecture 10 - Control structures
Lecture 11 - Data visualization in R Basic graphics
Lecture 12 - Linear Algebra for Data science
Lecture 13 - Solving Linear Equations
Lecture 14 - Solving Linear Equations (Continued...)
Lecture 15 - Linear Algebra - Distance,Hyperplanes and Halfspaces,Eigenvalues,Eigenvectors
Lecture 16 - Linear Algebra - Distance,Hyperplanes and Halfspaces,Eigenvalues,Eigenvectors (Continued... 1)
Lecture 17 - Linear Algebra - Distance,Hyperplanes and Halfspaces,Eigenvalues,Eigenvectors (Continued... 2)
Lecture 18 - Linear Algebra - Distance,Hyperplanes and Halfspaces,Eigenvalues,Eigenvectors (Continued... 3)
Lecture 19 - Statistical Modelling
Lecture 20 - Random Variables and Probability Mass/Density Functions
Lecture 21 - Sample Statistics
Lecture 22 - Hypotheses Testing
Lecture 23 - Optimization for Data Science
Lecture 24 - Unconstrained Multivariate Optimization
Lecture 25 - Unconstrained Multivariate Optimization (Continued...)
Lecture 26 - Gradient (Steepest) Descent (OR) Learning Rule
Lecture 27 - Multivariate Optimization With Equality Constraints
Lecture 28 - Multivariate Optimization With Inequality Constraints
Lecture 29 - Introduction to Data Science

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Lecture 30 - Solving Data Analysis Problems - A Guided Thought Process
Lecture 31 - Module
Lecture 32 - Linear Regression
Lecture 33 - Model Assessment
Lecture 34 - Diagnostics to Improve Linear Model Fit
Lecture 35 - Simple Linear Regression Model Building
Lecture 36 - Simple Linear Regression Model Assessment
Lecture 37 - Simple Linear Regression Model Assessment (Continued...)
Lecture 38 - Muliple Linear Regression
Lecture 39 - Cross Validation
Lecture 40 - Multiple Linear Regression Modelling Building and Selection
Lecture 41 - Classification
Lecture 42 - Logisitic Regression
Lecture 43 - Logisitic Regression (Continued...)
Lecture 44 - Performance Measures
Lecture 45 - Logisitic Regression Implementation in R
Lecture 46 - K-Nearest Neighbors (kNN)
Lecture 47 - K-Nearest Neighbors implementation in R
Lecture 48 - K-means Clustering
Lecture 49 - K-means implementation in R
Lecture 50 - Data Science for engineers - Summary
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NPTEL Video Course - Computer Science and Engineering - NOC:The Joy of Computing using Python

Subject Co-ordinator - Prof. Sudarshan Iyengar

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to Programming
Lecture 2 - Why Programming ?
Lecture 3 - Programming for Everybody
Lecture 4 - Any Prerequisites ?
Lecture 5 - Where to start?
Lecture 6 - Why do we have so many languages?
Lecture 7 - How to go about programming?
Lecture 8 - Why to learn programming?
Lecture 9 - What is programming?
Lecture 10 - How to give instructions ?
Lecture 11 - Introduction To Scratch
Lecture 12 - Introduction To Loops
Lecture 13 - More About Loops
Lecture 14 - Solution To Looping Problem
Lecture 15 - Scratch
Lecture 16 - Scratch
Lecture 17 - Scratch
Lecture 18 - More On Scratch
Lecture 19 - Introduction to Anaconda
Lecture 20 - Installation of Anaconda
Lecture 21 - Introduction to Spyder IDE
Lecture 22 - Printing statements in Python
Lecture 23 - Understanding Variables in Python
Lecture 24 - Executing a sequence of instructions in the Console
Lecture 25 - Writing your First Program
Lecture 26 - Taking inputs from the user
Lecture 27 - Discount Calculation
Lecture 28 - Motivation to if condition
Lecture 29 - A reminder on how to deal with numbers

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Lecture 30 - Understanding if condition's working
Lecture 31 - Realizing the importance of syntax and indentation
Lecture 32 - Introductions to loops
Lecture 33 - Loops
Lecture 34 - Loops
Lecture 35 - Loops
Lecture 36 - Introducction to While Loop
Lecture 37 - Lists Part 1
Lecture 38 - Lists Part 2
Lecture 39 - Lists Part 3
Lecture 40 - Lists Part 4
Lecture 41 - Loops and Conditionals
Lecture 42 - Loops and Conditionals
Lecture 43 - Crowd Computing - Just estimate 01
Lecture 44 - Crowd Computing - Just estimate 02
Lecture 45 - Crowd Computing - Just estimate 03
Lecture 46 - Crowd Computing - Just estimate 04
Lecture 47 - Crowd Computing - Just estimate 05
Lecture 48 - Crowd Computing - Just estimate 06
Lecture 49 - Permutations - Jumbled Words 01
Lecture 50 - Permutations - Jumbled Words 02
Lecture 51 - Permutations - Jumbled Words 03
Lecture 52 - Theory of Evolution 01
Lecture 53 - Theory of Evolution 02
Lecture 54 - Theory of Evolution 03
Lecture 55 - Theory of Evolution 04
Lecture 56 - Practice is the key
Lecture 57 - Magic Square Hit and Trial 01
Lecture 58 - Magic Square Hit and Trial 02
Lecture 59 - Magic Square Hit and Trial 03
Lecture 60 - Magic Square Hit and Trial 04
Lecture 61 - Magic Square Hit and Trial 05
Lecture 62 - Let's program and play
Lecture 63 - Dobble Game - Spot the similarity 01
Lecture 64 - Dobble Game - Spot the similarity 02
Lecture 65 - Dobble Game - Spot the similarity 03
Lecture 66 - Dobble Game - Spot the similarity 04
Lecture 67 - What is your date of birth?
Lecture 68 - Birthday Paradox - Find your twin 01
```

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```
Lecture 69 - Birthday Paradox - Find your twin 02
Lecture 70 - Birthday Paradox - Find your twin 03
Lecture 71 - Birthday Paradox - Find your twin 04
Lecture 72 - Birthday Paradox - Find your twin 05
Lecture 73 - What's your favourite movie?
Lecture 74 - Guess the Movie Name 01
Lecture 75 - Guess the Movie Name 02
Lecture 76 - Guess the Movie Name 03
Lecture 77 - Guess the Movie Name 04
Lecture 78 - Guess the Movie Name 05
Lecture 79 - Guess the Movie Name 06
Lecture 80 - Dictionaries
Lecture 81 - Speech to Text
Lecture 82 - Speech to Text
Lecture 83 - Speech to Text
Lecture 84 - Monte Hall
Lecture 85 - Monte Hall
Lecture 86 - Rock, Paper and Scissor
Lecture 87 - Rock, Paper and Scissor
Lecture 88 - Rock, Paper and Scissor
Lecture 89 - Rock, Paper and Scissor
Lecture 90 - Sorting and Searching
Lecture 91 - Sorting and Searching
Lecture 92 - Sorting and Searching
Lecture 93 - Sorting and Searching
Lecture 94 - Sorting and Searching
Lecture 95 - Sorting and Searching
Lecture 96 - Sorting and Searching
Lecture 97 - Sorting and Searching
Lecture 98 - Substitution Cipher -The science of secrecy
Lecture 99 - Substitution Cipher -The science of secrecy 01
Lecture 100 - Substitution Cipher -The science of secrecy 02
Lecture 101 - Substitution Cipher -The science of secrecy 03
Lecture 102 - Tic Tac Toe - Down the memory Lane
Lecture 103 - Tic Tac Toe - Down the memory Lane 01
Lecture 104 - Tic Tac Toe - Down the memory Lane 02
Lecture 105 - Tic Tac Toe - Down the memory Lane 03
Lecture 106 - Tic Tac Toe - Down the memory Lane 04
Lecture 107 - Tic Tac Toe - Down the memory Lane 05
```

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```
Lecture 108 - Recursion
Lecture 109 - Recursion 01
Lecture 110 - Recursion 02
Lecture 111 - Recursion 03
Lecture 112 - Recursion 04
Lecture 113 - Recursion 05
Lecture 114 - Recursion 06
Lecture 115 - Snakes and Ladders - Not on the Board
Lecture 116 - Snakes and Ladders - Not on the Board - Part 01
Lecture 117 - Snakes and Ladders - Not on the Board - Part 02
Lecture 118 - Snakes and Ladders - Not on the Board - Part 03
Lecture 119 - Snakes and Ladders - Not on the Board - Part 04
Lecture 120 - Snakes and Ladders - Not on the Board - Part 05
Lecture 121 - Snakes and Ladders - Not on the Board - Part 06
Lecture 122 - Spiral Traversing - Let's Animate
Lecture 123 - Spiral Traversing - Let's Animate - Part 01
Lecture 124 - Spiral Traversing - Let's Animate - Part 02
Lecture 125 - Spiral Traversing - Let's Animate - Part 03
Lecture 126 - Spiral Traversing - Let's Animate - Part 04
Lecture 127 - Spiral Traversing - Let's Animate - Part 05
Lecture 128 - Spiral Traversing - Let's Animate - Part 06
Lecture 129 - Spiral Traversing - Let's Animate - Part 07
Lecture 130 - GPS - Track the route
Lecture 131 - GPS - Track the route - Part 01
Lecture 132 - GPS - Track the route - Part 02
Lecture 133 - GPS - Track the route - Part 03
Lecture 134 - GPS - Track the route - Part 04
Lecture 135 - Tuples- Python Data Structure
Lecture 136 - Lottery Simulation - Profit or Loss
Lecture 137 - Lottery Simulation - Profit or Loss - Part 01
Lecture 138 - Lottery Simulation - Profit or Loss - Part 02
Lecture 139 - Lottery Simulation - Profit or Loss - Part 03
Lecture 140 - Lottery Simulation - Profit or Loss - Part 04
Lecture 141 - Lottery Simulation - Profit or Loss - Part 05
Lecture 142 - Lottery Simulation - Profit or Loss - Part 06
Lecture 143 - Image Processing - Enhance your images
Lecture 144 - Image Processing - Enhance your images - Part 01
Lecture 145 - Image Processing - Enhance your images - Part 02
Lecture 146 - Image Processing - Enhance your images - Part 03
```

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```
Lecture 147 - Anagrams
Lecture 148 - Anagrams - Part 01
Lecture 149 - Anagrams - Part 02
Lecture 150 - Anagrams - Part 03
Lecture 151 - Anagrams - Part 04
Lecture 152 - Facebook Sentiment Analysis
Lecture 153 - Facebook Sentiment Analysis - Part 01
Lecture 154 - Facebook Sentiment Analysis - Part 02
Lecture 155 - Facebook Sentiment Analysis - Part 03
Lecture 156 - Facebook Sentiment Analysis - Part 04
Lecture 157 - Natural Language Processing - Author Stylometry
Lecture 158 - Natural Language Processing - Author Stylometry - Part 01
Lecture 159 - Natural Language Processing - Author Stylometry - Part 02
Lecture 160 - Natural Language Processing - Author Stylometry - Part 03
Lecture 161 - Natural Language Processing - Author Stylometry - Part 04
Lecture 162 - Natural Language Processing - Author Stylometry - Part 05
Lecture 163 - Natural Language Processing - Author Stylometry - Part 06
Lecture 164 - Natural Language Processing - Author Stylometry - Part 07
Lecture 165 - Natural Language Processing - Author Stylometry - Part 08
Lecture 166 - Natural Language Processing - Author Stylometry - Part 09
Lecture 167 - Natural Language Processing - Author Stylometry - Part 10
Lecture 168 - Introduction to Networkx - Part 01
Lecture 169 - Introduction to Networkx - Part 02
Lecture 170 - Six Degrees of Separation
Lecture 171 - Six Degrees of Separation
Lecture 172 - Six Degrees of Separation
Lecture 173 - Six Degrees of Separation
Lecture 174 - Area Calculation - Don't Measure
Lecture 175 - Area Calculation - Don't Measure - Part 01
Lecture 176 - Area Calculation - Don't Measure - Part 02
Lecture 177 - Area Calculation - Don't Measure - Part 03
Lecture 178 - Area Calculation - Don't Measure - Part 04
Lecture 179 - Area Calculation - Don't Measure - Part 05
Lecture 180 - Area Calculation - Don't Measure - Part 06
Lecture 181 - FLAMES - Part 01
Lecture 182 - FLAMES - Part 02
Lecture 183 - FLAMES - Part 03
Lecture 184 - FLAMES - Part 04
Lecture 185 - FLAMES - Part 05
```

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```
Lecture 186 - FLAMES - Part 06
Lecture 187 - Data Compression - Part 01
Lecture 188 - Data Compression - Part 02
Lecture 189 - Data Compression - Part 03
Lecture 190 - Data Compression - Part 04
Lecture 191 - Data Compression - Part 05
Lecture 192 - Browser Automation Watsapp using Python - Part 01
Lecture 193 - Browser Automation Watsapp using Python - Part 02
Lecture 194 - Browser Automation Watsapp using Python - Part 03
Lecture 195 - Browser Automation Watsapp using Python - Part 04
Lecture 196 - Fun with Calendar - Part 01
Lecture 197 - Fun with Calendar - Part 02
Lecture 198 - Fun with Calendar - Part 03
Lecture 199 - Fun with Calendar - Part 04
Lecture 200 - Fun with Calendar - Part 05
Lecture 201 - Fun with Calendar - Part 06
Lecture 202 - Fun with Calendar - Part 07
Lecture 203 - Fun with Calendar - Part 08
Lecture 204 - Fun with Calendar - Part 09
Lecture 205 - Fun with Calendar - Part 10
Lecture 206 - Fun with Calendar - Part 11
Lecture 207 - Fun with Calendar - Part 12
Lecture 208 - Page Rank - How does Google Work ? - Part 01
Lecture 209 - Page Rank - How does Google Work ? - Part 02
Lecture 210 - Page Rank - How does Google Work ? - Part 03
Lecture 211 - Page Rank - How does Google Work ? - Part 04
Lecture 212 - Page Rank - How does Google Work ? - Part 05
Lecture 213 - Page Rank - How does Google Work ? - Part 06
Lecture 214 - Page Rank - How does Google Work ? - Part 07
Lecture 215 - Page Rank - How does Google Work ? - Part 08
Lecture 216 - Page Rank - How does Google Work ? - Part 09
Lecture 217 - Page Rank - How does Google Work ? - Part 10
Lecture 218 - Page Rank - How does Google Work ? - Part 11
Lecture 219 - Page Rank - How does Google Work ? - Part 12
Lecture 220 - Page Rank - How does Google Work ? - Part 13
Lecture 221 - Page Rank - How does Google Work ? - Part 14
Lecture 222 - Page Rank - How does Google Work ? - Part 15
Lecture 223 - Page Rank - How does Google Work ? - Part 16
Lecture 224 - Collatz Conjecture - Part 01
```

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Lecture 225 - Collatz Conjecture - Part 02
Lecture 226 - JOC Conclusion

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NPTEL Video Course - Computer Science and Engineering - NOC:Discrete Mathematics

Subject Co-ordinator - Prof. Sudarshan Iyengar

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable │ MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Motivation for Counting
Lecture 2 - Paper Folding Example
Lecture 3 - Rubik's Cube Example
Lecture 4 - Factorial Example
Lecture 5 - Counting in Computer Science
Lecture 6 - Motivation for Catalan numbers
Lecture 7 - Rule of Sum and Rule of Product
Lecture 8 - Problems on Rule of Sum and Rule of Product
Lecture 9 - Factorial Explained
Lecture 10 - Proof of n! - Part 1
Lecture 11 - Proof of n! - Part 2
Lecture 12 - Astronomical Numbers
Lecture 13 - Permutations - Part 1
Lecture 14 - Permutations - Part 2
Lecture 15 - Permutations - Part 3
Lecture 16 - Permutations - Part 4
Lecture 17 - Problems on Permutations
Lecture 18 - Combinations - Part 1
Lecture 19 - Combinations - Part 2
Lecture 20 - Combinations - Part 3
Lecture 21 - Combinations - Part 4
Lecture 22 - Problems on Combinations
Lecture 23 - Difference between Permuations and Combinations
Lecture 24 - Combination with Repetition - Part 1
Lecture 25 - Combination with Repetition - Part 2
Lecture 26 - Combination with Repetition - Problems
Lecture 27 - Binomial theorem
Lecture 28 - Applications of Binomial theorem
Lecture 29 - Properties of Binomial theorem

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```
Lecture 30 - Multinomial theorem
Lecture 31 - Problems on Binomial theorem
Lecture 32 - Pascal's Triangle
Lecture 33 - Fun facts on Pascal's Triangle
Lecture 34 - Catalan Numbers - Part 1
Lecture 35 - Catalan Numbers - Part 2
Lecture 36 - Catalan Numbers - Part 3
Lecture 37 - Catalan Numbers - Part 4
Lecture 38 - Examples of Catalan numbers
Lecture 39 - Chapter Summary
Lecture 40 - Introduction to Set Theory
Lecture 41 - Example, definiton and notation
Lecture 42 - Sets - Problems Part 1
Lecture 43 - Subsets - Part 1
Lecture 44 - Subsets - Part 2
Lecture 45 - Subsets - Part 3
Lecture 46 - Union and intersections of sets
Lecture 47 - Union and intersections of sets - Part 1
Lecture 48 - Union and intersections of sets - Part 2
Lecture 49 - Union and intersections of sets - Part 3
Lecture 50 - Cardinality of Union of two sets - Part 1
Lecture 51 - Cardinality of Union of two sets - Part 2
Lecture 52 - Cardinality of Union of three sets
Lecture 53 - Power Set - Part 1
Lecture 54 - Power set - Part 2
Lecture 55 - Power set - Part 3
Lecture 56 - Connection betwenn Binomial Theorem and Power Sets
Lecture 57 - Power set - Problems
Lecture 58 - Complement of a set
Lecture 59 - De Morgan's Laws - Part 1
Lecture 60 - De Morgan's Laws - Part 2
Lecture 61 - A proof technique
Lecture 62 - De Morgan's Laws - Part 3
Lecture 63 - De Morgan's Laws - Part 4
Lecture 64 - Set difference - Part 1
Lecture 65 - Set difference - Part 2
Lecture 66 - Symmetric difference
Lecture 67 - History
Lecture 68 - Summary
```

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```
Lecture 69 - Motivational example
Lecture 70 - Introduction to Statements
Lecture 71 - Examples and Non-examples of Statements
Lecture 72 - Introduction to Negation
Lecture 73 - Negation - Explanation
Lecture 74 - Negation - Truthtable
Lecture 75 - Examples for Negation
Lecture 76 - Motivation for OR operator
Lecture 77 - Introduction to OR operator
Lecture 78 - Truthtable for OR operator
Lecture 79 - OR operator for 3 Variables
Lecture 80 - Truthtable for AND operator
Lecture 81 - AND operator for 3 Variables
Lecture 82 - Primitive and Compound statements - Part 1
Lecture 83 - Primitive and Compound statements - Part 2
Lecture 84 - Problems involoving NOT, OR and AND operators
Lecture 85 - Introduction to implication
Lecture 86 - Examples and Non-examples of Implication - Part 1
Lecture 87 - Examples and Non-examples of Implication - Part 2
Lecture 88 - Explanation of Implication
Lecture 89 - Introduction to Double Implication
Lecture 90 - Explanation of Double Implication
Lecture 91 - Converse, Inverse and Contrapositive
Lecture 92 - XOR operator - Part 1
Lecture 93 - XOR operator - Part 2
Lecture 94 - XOR operator - Part 3
Lecture 95 - Problems
Lecture 96 - Tautology, Contradiction - Part 1
Lecture 97 - Tautology, Contradiction - Part 2
Lecture 98 - Tautology, Contradiction - Part 3
Lecture 99 - SAT Problem - Part 1
Lecture 100 - SAT Problem - Part 2
Lecture 101 - Logical Equivalence - Part 1
Lecture 102 - Logical Equivalence - Part 2
Lecture 103 - Logical Equivalence - Part 3
Lecture 104 - Logical Equivalence - Part 4
Lecture 105 - Motivation for laws of logic
Lecture 106 - Double negation - Part 1
Lecture 107 - Double negation - Part 2
```

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```
Lecture 108 - Laws of Logic
Lecture 109 - De Morgan's Law - Part 1
Lecture 110 - De Morgan's Law - Part 2
Lecture 111 - Rules of Inferences - Part 1
Lecture 112 - Rules of Inferences - Part 2
Lecture 113 - Rules of Inferences - Part 3
Lecture 114 - Rules of Inferences - Part 4
Lecture 115 - Rules of Inferences - Part 5
Lecture 116 - Rules of Inferences - Part 6
Lecture 117 - Rules of Inferences - Part 7
Lecture 118 - Conclusion
Lecture 119 - Introduction to Relation
Lecture 120 - Graphical Representation of a Relation
Lecture 121 - Various sets
Lecture 122 - Matrix Representation of a Relation
Lecture 123 - Relation - An Example
Lecture 124 - Cartesian Product
Lecture 125 - Set Representation of a Relation
Lecture 126 - Revisiting Representations of a Relation
Lecture 127 - Examples of Relations
Lecture 128 - Number of relations - Part 1
Lecture 129 - Number of relations - Part 2
Lecture 130 - Reflexive relation - Introduction
Lecture 131 - Example of a Reflexive relation
Lecture 132 - Reflexive relation - Matrix representation
Lecture 133 - Number of Reflexive relations
Lecture 134 - Symmetric Relation - Introduction
Lecture 135 - Symmetric Relation - Matrix representation
Lecture 136 - Symmetric Relation - Examples and non examples
Lecture 137 - Parallel lines revisited
Lecture 138 - Number of symmetric relations - Part 1
Lecture 139 - Number of symmetric relations - Part 2
Lecture 140 - Examples of Reflexive and Symmetric Relations
Lecture 141 - Pattern
Lecture 142 - Transitive relation - Examples and non examples
Lecture 143 - Antisymmetric relation
Lecture 144 - Examples of Transitive and Antisymmetric Relation
Lecture 145 - Antisymmetric - Graphical representation
Lecture 146 - Antisymmetric - Matrix representation
```

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```
Lecture 147 - Number of Antisymmetric relations
Lecture 148 - Condition for relation to be reflexive
Lecture 149 - Few notations
Lecture 150 - Condition for relation to be reflexive
Lecture 151 - Condition for relation to be reflexive
Lecture 152 - Condition for relation to be symmetric
Lecture 153 - Condition for relation to be symmetric
Lecture 154 - Condition for relation to be antisymmetric
Lecture 155 - Equivalence relation
Lecture 156 - Equivalence relation - Example 4
Lecture 157 - Partition - Part 1
Lecture 158 - Partition - Part 2
Lecture 159 - Partition - Part 3
Lecture 160 - Partition - Part 4
Lecture 161 - Partition - Part 5
Lecture 162 - Partition - Part 6
Lecture 163 - Motivational Example - 1
Lecture 164 - Motivational Example - 2
Lecture 165 - Commonality in examples
Lecture 166 - Motivational Example - 3
Lecture 167 - Example - 4 Explanation
Lecture 168 - Introduction to functions
Lecture 169 - Defintion of a function - Part 1
Lecture 170 - Defintion of a function - Part 2
Lecture 171 - Defintion of a function - Part 3
Lecture 172 - Relations vs Functions - Part 1
Lecture 173 - Relations vs Functions - Part 2
Lecture 174 - Introduction to One-One Function
Lecture 175 - One-One Function - Example 1
Lecture 176 - One-One Function - Example 2
Lecture 177 - One-One Function - Example 3
Lecture 178 - Proving a Function is One-One
Lecture 179 - Examples and Non- examples of One-One function
Lecture 180 - Cardinality condition in One-One function - Part 1
Lecture 181 - Cardinality condition in One-One function - Part 2
Lecture 182 - Introduction to Onto Function - Part 1
Lecture 183 - Introduction to Onto Function - Part 2
Lecture 184 - Definition of Onto Function
Lecture 185 - Examples of Onto Function
```

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```
Lecture 186 - Cardinality condition in Onto function - Part 1
Lecture 187 - Cardinality condition in Onto function - Part 2
Lecture 188 - Introduction to Bijection
Lecture 189 - Examples of Bijection
Lecture 190 - Cardinality condition in Bijection - Part 1
Lecture 191 - Cardinality condition in Bijection - Part 2
Lecture 192 - Counting number of functions
Lecture 193 - Number of functions
Lecture 194 - Number of One-One functions - Part 1
Lecture 195 - Number of One-One functions - Part 2
Lecture 196 - Number of One-One functions - Part 3
Lecture 197 - Number of Onto functions
Lecture 198 - Number of Bijections
Lecture 199 - Counting number of functions.
Lecture 200 - Motivation for Composition of functions - Part 1
Lecture 201 - Motivation for Composition of functions - Part 2
Lecture 202 - Definition of Composition of functions
Lecture 203 - Why study Composition of functions
Lecture 204 - Example of Composition of functions - Part 1
Lecture 205 - Example of Composition of functions - Part 2
Lecture 206 - Motivation for Inverse functions
Lecture 207 - Inverse functions
Lecture 208 - Examples of Inverse functions
Lecture 209 - Application of inverse functions - Part 1
Lecture 210 - Three stories
Lecture 211 - Three stories - Connecting the dots
Lecture 212 - Mathematical induction - An illustration
Lecture 213 - Mathematical Induction - Its essence
Lecture 214 - Mathematical Induction - The formal way
Lecture 215 - MI - Sum of odd numbers
Lecture 216 - MI - Sum of powers of 2
Lecture 217 - MI - Inequality 1
Lecture 218 - MI - Inequality 1 (solution)
Lecture 219 - MI - To prove divisibility
Lecture 220 - MI - To prove divisibility (solution)
Lecture 221 - MI - Problem on satisfying inequalities
Lecture 222 - MI - Problem on satisfying inequalities (solutions)
Lecture 223 - MI - Inequality 2
Lecture 224 - MI - Inequality 2 solution
```

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Lecture 225 - Mathematical Induction - Example 9
Lecture 226 - Mathematical Induction - Example 10 solution
Lecture 227 - Binomial Coeffecients - Proof by induction
Lecture 228 - Checker board and Triomioes - A puzzle
Lecture 229 - Checker board and triominoes - Solution
Lecture 230 - Mathematical induction - An important note
Lecture 231 - Mathematical Induction - A false proof
Lecture 232 - A false proof - Solution
Lecture 233 - Motivation for Pegionhole Principle
Lecture 234 - Group of n people
Lecture 235 - Set of n integgers
Lecture 236 - 10 points on an equilateral triangle
Lecture 237 - Pegionhole Principle - A result
Lecture 238 - Consecutive integers
Lecture 239 - Consecutive integers solution
Lecture 240 - Matching initials
Lecture 241 - Matching initials - Solution
Lecture 242 - Numbers adding to 9
Lecture 243 - Numbers adding to 9 - Solution
Lecture 244 - Deck of cards
Lecture 245 - Deck of cards - Solution
Lecture 246 - Number of errors
Lecture 247 - Number of errors - Solution
Lecture 248 - Puzzle - Challenge for you
Lecture 249 - Friendship - an interesting property
Lecture 250 - Connectedness through Connecting people
Lecture 251 - Traversing the bridges
Lecture 252 - Three utilities problem
Lecture 253 - Coloring the India map
Lecture 254 - Defintion of a Graph
Lecture 255 - Degree and degree sequence
Lecture 256 - Relation between number of edges and degrees
Lecture 257 - Relation between number of edges and degrees - Proof
Lecture 258 - Hand shaking lemma - Corollary
Lecture 259 - Problems based on Hand shaking lemma
Lecture 260 - Havel Hakimi theorem - Part 1
Lecture 261 - Havel Hakimi theorem - Part 2
Lecture 262 - Havel Hakimi theorem - Part 3
Lecture 263 - Havel Hakimi theorem - Part 4
```

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```
Lecture 264 - Havel Hakimi theorem - Part 5
Lecture 265 - Regular graph and irregular graph
Lecture 266 - Walk
Lecture 267 - Trail
Lecture 268 - Path and closed path
Lecture 269 - Definitions revisited
Lecture 270 - Examples of walk, trail and path
Lecture 271 - Cycle and circuit
Lecture 272 - Example of cycle and circuit
Lecture 273 - Relation between walk and path
Lecture 274 - Relation between walk and path - An induction proof
Lecture 275 - Subgraph
Lecture 276 - Spanning and induced subgraph
Lecture 277 - Spanning and induced subgraph - A result
Lecture 278 - Introduction to Tree
Lecture 279 - Connected and Disconnected graphs
Lecture 280 - Property of a cycle
Lecture 281 - Edge condition for connectivity
Lecture 282 - Connecting connectedness and path
Lecture 283 - Connecting connectedness and path - An illustration
Lecture 284 - Cut vertex
Lecture 285 - Cut edge
Lecture 286 - Illustration of cut vertices and cut edges
Lecture 287 - NetworkX - Need of the hour
Lecture 288 - Introduction to Python - Installation
Lecture 289 - Introduction to Python - Basics
Lecture 290 - Introduction to NetworkX
Lecture 291 - Story so far - Using NetworkX
Lecture 292 - Directed, weighted and multi graphs
Lecture 293 - Illustration of Directed, weighted and multi graphs
Lecture 294 - Graph representations - Introduction
Lecture 295 - Adjacency matrix representation
Lecture 296 - Incidence matrix representation
Lecture 297 - Isomorphism - Introduction
Lecture 298 - Isomorphic graphs - An illustration
Lecture 299 - Isomorphic graphs - A challenge
Lecture 300 - Non-isomorphic graphs
Lecture 301 - Isomorphism - A question
Lecture 302 - Complement of a Graph - Introduction
```

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```
Lecture 303 - Complement of a Graph - Illiustration
Lecture 304 - Self complement
Lecture 305 - Complement of a disconnected graph is connected
Lecture 306 - Complement of a disconnected graph is connected - Solution
Lecture 307 - Which is more? Connected graphs or disconnected graphs?
Lecture 308 - Bipartite graphs.
Lecture 309 - Bipartite graphs
Lecture 310 - Bipartite graphs - A puzzle
Lecture 311 - Bipartite graphs - Converse part of the puzzle
Lecture 312 - Definition of Eulerian Graph
Lecture 313 - Illustration of eulerian graph
Lecture 314 - Non- example of Eulerian graph
Lecture 315 - Litmus test for an Eulerian graph
Lecture 316 - Why even degree?
Lecture 317 - Proof for even degree implies graph is eulerian
Lecture 318 - A condition for Eulerian trail
Lecture 319 - Why the name Eulerian
Lecture 320 - Can you traverse all location?
Lecture 321 - Defintion of Hamiltonian graphs
Lecture 322 - Examples of Hamiltonian graphs
Lecture 323 - Hamiltonian graph - A result
Lecture 324 - A result on connectedness
Lecture 325 - A result on Path
Lecture 326 - Dirac's Theorem
Lecture 327 - Dirac's theorem - A note
Lecture 328 - Ore's Theorem
Lecture 329 - Dirac's Theorem v/s Ore's Theorem
Lecture 330 - Eulerian and Hamiltonian Are they related
Lecture 331 - Importance of Hamiltonian graphs in Computer science
Lecture 332 - Constructing non intersecting roads
Lecture 333 - Definition of a Planar graph
Lecture 334 - Examples of Planar graphs
Lecture 335 - V - E + R = 2
Lecture 336 - Illustration of V - E + R =2
Lecture 337 - V - E + R = 2; Use induction
Lecture 338 - Proof of V - E + R = 2
Lecture 339 - Famous non-planar graphs
Lecture 340 - Litmus test for planarity
Lecture 341 - Planar graphs - Inequality 1
```

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```
Lecture 342 - 3 Utilities problem - Revisited
Lecture 343 - Complete graph on 5 vertices is non-planar - Proof
Lecture 344 - Prisoners and cells
Lecture 345 - Prisoners example and Proper coloring
Lecture 346 - Chromatic number of a graph
Lecture 347 - Examples on Proper coloring
Lecture 348 - Recalling the India map problem
Lecture 349 - Recalling the India map problem - Solution
Lecture 350 - NetworkX - Digraphs
Lecture 351 - NetworkX - Adjacency matrix
Lecture 352 - NetworkX - Random graphs
Lecture 353 - NetworkX - Subgarph
Lecture 354 - NetworkX - Isomorphic graphs Part 1
Lecture 355 - NetworkX - Isomorphic graphs Part 2
Lecture 356 - NetworkX - Isomorphic graphs
Lecture 357 - NetworkX - Graph complement
Lecture 358 - NetworkX - Eulerian graphs
Lecture 359 - NetworkX - Bipaprtite graphs
Lecture 360 - NetworkX - Coloring
Lecture 361 - Counting in a creative way
Lecture 362 - Example 1 - Fun with words
Lecture 363 - Words and the polynomial
Lecture 364 - Words and the polynomial - Explained
Lecture 365 - Example 2 - Picking five balls
Lecture 366 - Picking five balls - Solution
Lecture 367 - Picking five balls - Another version
Lecture 368 - Defintion of Generating function
Lecture 369 - Generating function examples - Part 1
Lecture 370 - Generating function examples - Part 2
Lecture 371 - Generating function examples - Part 3
Lecture 372 - Binomial expansion - A generating function
Lecture 373 - Binomial expansion - Explained
Lecture 374 - Picking 7 balls - The naive way
Lecture 375 - Picking 7 balls - The creative way
Lecture 376 - Generating functions - Problem 1
Lecture 377 - Generating functions - Problem 2
Lecture 378 - Generating functions - Problem 3
Lecture 379 - Why Generating function?
Lecture 380 - Introduction to Advanced Counting
```

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```
Lecture 381 - Example 1
Lecture 382 - Inclusion-Exclusion Formula
Lecture 383 - Proof of Inclusion - Exlusion formula
Lecture 384 - Example 2
Lecture 385 - Example 3
Lecture 386 - Example 4
Lecture 387 - Example 5
Lecture 388 - Example 6
Lecture 389 - A tip in solving problems
Lecture 390 - Example 7
Lecture 391 - Example 8
Lecture 392 - Example 10
Lecture 393 - Example 11
Lecture 394 - Example 11
Lecture 395 - Example 12
Lecture 396 - Number of Onto Functions.
Lecture 397 - Formula for Number of Onto Functions
Lecture 398 - Example 13
Lecture 399 - Example 14
Lecture 400 - Derangements
Lecture 401 - Derangements of 4 numbers
Lecture 402 - Example 15
Lecture 403 - Example 16
Lecture 404 - Example 17
Lecture 405 - Example 18
Lecture 406 - Example 19
Lecture 407 - Placing rooks on the chessboard
Lecture 408 - Rook Polynomial
Lecture 409 - Rook Polynomial
Lecture 410 - Motivation for recurrence relation
Lecture 411 - Getting started with recurrence relations
Lecture 412 - What is a recurrence relation?
Lecture 413 - Compound Interest as a recurrence relation
Lecture 414 - Examples of recurrence relations
Lecture 415 - Example - Number of ways of climbing steps
Lecture 416 - Number of ways of climbing steps
Lecture 417 - Example - Rabbits on an island
Lecture 418 - Example - n-bit string
Lecture 419 - Example - n-bit string without consecutive zero
```

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Lecture 420 - Solving Linear Recurrence Relations - A theorem
Lecture 421 - A note on the proof
Lecture 422 - Soving recurrence relation - Example 1
Lecture 423 - Soving recurrence relation - Example 2
Lecture 424 - Fibonacci Sequence
Lecture 425 - Introduction to Fibonacci sequence
Lecture 426 - Solution of Fibbonacci sequence
Lecture 427 - A basic introduction to 'complexity'
Lecture 428 - Intuition for 'complexity'
Lecture 429 - Visualizing complexity order as a graph
Lecture 430 - Tower of Hanoi
Lecture 431 - Reccurence relation of Tower of Hanoi
Lecture 432 - Solution for the recurrence relation of Tower of Hanoi
Lecture 433 - A searching technique
Lecture 434 - Recurrence relation for Binary search
Lecture 435 - Solution for the recurrence relation of Binary search
Lecture 436 - Example
Lecture 437 - Example
Lecture 438 - Door knock example and Merge sort
Lecture 439 - Introduction to Merge sort - 1
Lecture 440 - Recurrence relation for Merge sort
Lecture 441 - Intoduction to advanced topics
Lecture 442 - Introduction to Chromatic polynomial
Lecture 443 - Chromatic polynomial of complete graphs
Lecture 444 - Chromatic polynomial of cycle on 4 vertices - Part 1
Lecture 445 - Chromatic polynomial of cycle on 4 vertices - Part 2
Lecture 446 - Correspondence between partition and generating functions
Lecture 447 - Correspondence between partition and generating functions
Lecture 448 - Distinct partitions and odd partitions
Lecture 449 - Distinct partitions and generating functions
Lecture 450 - Odd partitions and generating functions
Lecture 451 - Distinct partitions equals odd partitions
Lecture 452 - Distinct partitions equals odd partitions
Lecture 453 - Why 'partitions' to 'polynomial'?
Lecture 454 - Example
Lecture 455 - Motivation for exponential generating function
Lecture 456 - Recurrrence relation
Lecture 457 - Introduction to Group Theory
Lecture 458 - Uniqueness of the identity element
```

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Lecture 459 - Formal definition of a Group
Lecture 460 - Groups
Lecture 461 - Groups
Lecture 462 - Groups
Lecture 463 - Subgroup
Lecture 464 - Lagrange's theorem
Lecture 465 - Summary
Lecture 466 - Conclusion
```

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NPTEL Video Course - Computer Science and Engineering - NOC:Deep Learning

Subject Co-ordinator - Prof.Mitesh Khapra

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable │ MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Biological Neuron
Lecture 2 - From Spring to Winter of AI
Lecture 3 - The Deep Revival
Lecture 4 - From Cats to Convolutional Neural Networks
Lecture 5 - Faster, higher, stronger
Lecture 6 - The Curious Case of Sequences
Lecture 7 - Beating humans at their own games (literally)
Lecture 8 - The Madness (2013)
Lecture 9 - (Need for) Sanity
Lecture 10 - Motivation from Biological Neurons
Lecture 11 - McCulloch Pitts Neuron, Thresholding Logic
Lecture 12 - Perceptrons
Lecture 13 - Error and Error Surfaces
Lecture 14 - Perceptron Learning Algorithm
Lecture 15 - Proof of Convergence of Perceptron Learning Algorithm
Lecture 16 - Deep Learning (CS7015)
Lecture 17 - Deep Learning (CS7015)
Lecture 18 - Deep Learning (CS7015)
Lecture 19 - Deep Learning (CS7015)
Lecture 20 - Deep Learning (CS7015)
Lecture 21 - Deep Learning (CS7015)
Lecture 22 - Deep Learning (CS7015)
Lecture 23 - Feedforward Neural Networks (a.k.a multilayered network of neurons)
Lecture 24 - Learning Paramters of Feedforward Neural Networks (Intuition)
Lecture 25 - Output functions and Loss functions
Lecture 26 - Backpropagation (Intuition)
Lecture 27 - Backpropagation
Lecture 28 - Backpropagation
Lecture 29 - Backpropagation

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```
Lecture 30 - Backpropagation
Lecture 31 - Derivative of the activation function
Lecture 32 - Information content, Entropy and cross entropy
Lecture 33 - Recap
Lecture 34 - Contours Maps
Lecture 35 - Momentum based Gradient Descent
Lecture 36 - Nesterov Accelerated Gradient Descent
Lecture 37 - Stochastic And Mini-Batch Gradient Descent
Lecture 38 - Tips for Adjusting Learning Rate and Momentum
Lecture 39 - Line Search
Lecture 40 - Gradient Descent with Adaptive Learning Rate
Lecture 41 - Bias Correction in Adam
Lecture 42 - Eigenvalues and Eigenvectors
Lecture 43 - Linear Algebra
Lecture 44 - Eigenvalue Decompositon
Lecture 45 - Principal Component Analysis and its Interpretations
Lecture 46 - PCA
Lecture 47 - PCA
Lecture 48 - PCA
Lecture 49 - PCA
Lecture 50 - Singular Value Decomposition
Lecture 51 - Introduction to Autoncoders
Lecture 52 - Link between PCA and Autoencoders
Lecture 53 - Regularization in autoencoders (Motivation)
Lecture 54 - Denoising Autoencoders
Lecture 55 - Sparse Autoencoders
Lecture 56 - Contractive Autoencoders
Lecture 57 - Bias and Variance
Lecture 58 - Train error vs Test error
Lecture 59 - Train error vs Test error (Recap)
Lecture 60 - True error and Model complexity
Lecture 61 - L2 regularization
Lecture 62 - Dataset augmentation
Lecture 63 - Parameter sharing and tying
Lecture 64 - Adding Noise to the inputs
Lecture 65 - Adding Noise to the outputs
Lecture 66 - Early stopping
Lecture 67 - Ensemble Methods
Lecture 68 - Dropout
```

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Lecture 69 - A quick recap of training deep neural networks
Lecture 70 - Unsupervised pre-training
Lecture 71 - Better activation functions
Lecture 72 - Better initialization strategies
Lecture 73 - Batch Normalization
Lecture 74 - One-hot representations of words
Lecture 75 - Distributed Representations of words
Lecture 76 - SVD for learning word representations
Lecture 77 - SVD for learning word representations (Continued...)
Lecture 78 - Continuous bag of words model
Lecture 79 - Skip-gram model
Lecture 80 - Skip-gram model (Continued...)
Lecture 81 - Contrastive estimation
Lecture 82 - Hierarchical softmax
Lecture 83 - GloVe representations
Lecture 84 - Evaluating word representations
Lecture 85 - Relation between SVD and Word2Vec
Lecture 86 - The convolution operation
Lecture 87 - Relation between input size, output size and filter size
Lecture 88 - Convolutional Neural Networks
Lecture 89 - Convolutional Neural Networks (Continued...)
Lecture 90 - CNNs (success stories on ImageNet)
Lecture 91 - CNNs (success stories on ImageNet) (Continued...)
Lecture 92 - Image Classification continued (GoogLeNet and ResNet)
Lecture 93 - Visualizing patches which maximally activate a neuron
Lecture 94 - Visualizing filters of a CNN
Lecture 95 - Occlusion experiments
Lecture 96 - Finding influence of input pixels using backpropagation
Lecture 97 - Guided Backpropagation
Lecture 98 - Optimization over images
Lecture 99 - Create images from embeddings
Lecture 100 - Deep Dream
Lecture 101 - Deep Art
Lecture 102 - Fooling Deep Convolutional Neural Networks
Lecture 103 - Sequence Learning Problems
Lecture 104 - Recurrent Neural Networks
Lecture 105 - Backpropagation through time
Lecture 106 - The problem of Exploding and Vanishing Gradients
Lecture 107 - Some Gory Details

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Lecture 108 - Selective Read, Selective Write, Selective Forget - The Whiteboard Analogy
Lecture 109 - Long Short Term Memory (LSTM) and Gated Recurrent Units (GRUs)
Lecture 110 - How LSTMs avoid the problem of vanishing gradients
Lecture 111 - How LSTMs avoid the problem of vanishing gradients (Continued...)
Lecture 112 - Introduction to Encoder Decoder Models
Lecture 113 - Applications of Encoder Decoder models
Lecture 114 - Attention Mechanism
Lecture 115 - Attention Mechanism (Continued...)
Lecture 116 - Attention over images
Lecture 117 - Hierarchical Attention

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NPTEL Video Course - Computer Science and Engineering - NOC:Foundations to Computer Systems Design

Subject Co-ordinator - Prof. V. Kamakoti

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable


```
Lecture 1  - Introduction to the Course
Lecture 2  - CMOS Transistors and Gates
Lecture 3  - Basic Gates
Lecture 4  - Building Gates Using Simulator
Lecture 5  - Hierarchical Design and Verification
Lecture 6  - Building Blocks of a Digital Computer
Lecture 7  - Binary Number Systems
Lecture 8  - Signed Number Systems
Lecture 9  - Twos Complement Number System
Lecture 10 - Binary Adder Circuits
Lecture 11 - Building the ALU of HACK
Lecture 12 - HACK ALU Functionality
Lecture 13 - Tips for Project P1
Lecture 14 - Sequential Logic Design
Lecture 15 - Latches and Flipflops
Lecture 16 - The Memory Hierarchy
Lecture 17 - Design of Program Counter
Lecture 18 - Introduction to Computer Organization
Lecture 19 - Memory Mapped I/O
Lecture 20 - Tips for Projects P2 and P3
Lecture 21 - Tips for Project 4
Lecture 22 - Tips for Project 4
Lecture 23 - Introduction to Computer Architecture
Lecture 24 - The HACK Microarchitecture
Lecture 25 - The HACK CPU - A Deep Dive - Part 1
Lecture 26 - The HACK CPU - A Deep Dive - Part 2
Lecture 27 - The Data Memory
Lecture 28 - The HACK Computer
Lecture 29 - The Assembler Construction
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Lecture 30 - Understanding the Working of Assembler
Lecture 31 - Assembler
Lecture 32 - Assembler
Lecture 33 - Assembler
Lecture 34 - Project 6
Lecture 35 - Virtual Machines - What and Why?
Lecture 36 - The VM Instruction Set Architecture
Lecture 37 - The execution of a VM Program
Lecture 38 - How powerful is the VM?
Lecture 39 - Project 7
Lecture 40 - Project 7
Lecture 41 - Deep Understanding of VM ISA using VM Emulator
Lecture 42 - Virtual Machine II - Program flow commands and Introduction to Function Calls
Lecture 43 - Implementation of Function Call
Lecture 44 - Working of the Virtual Machine
Lecture 45 - Project 8
Lecture 46 - Handling Static Variables
Lecture 47 - Project 8
Lecture 48 - Introduction to The JACK Programming Language
Lecture 49 - Project 9
Lecture 50 - Understanding Syntax of JACK using Examples
Lecture 51 - Project 9
Lecture 52 - The JACK Syntax - Language Specification
Lecture 53 - Application Development using JACK
Lecture 54 - JACK Compiler
Lecture 55 - Project 10
Lecture 56 - The JACK Grammar
Lecture 57 - Compiler for JACK
Lecture 58 - The Token Analyzer
Lecture 59 - Testing the Correctness
Lecture 60 - The Jack Compiler - Back-end Introduction
Lecture 61 - The Jack Compiler - Handling Variables
Lecture 62 - The Jack Compiler - Handling Expressions
Lecture 63 - The Jack Compiler - Handling Flow of Control
Lecture 64 - The Jack Compiler - Handling Objects
Lecture 65 - The Jack Compiler - Handling Arrays
Lecture 66 - The Jack Compiler Backend
Lecture 67 - The Jack Compiler Backend
Lecture 68 - The Jack Compiler Backend
```

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Lecture 69 - The Jack Compiler Backend
Lecture 70 - The Jack Compiler Backend
Lecture 71 - The Jack Compiler Backend
Lecture 72 - Jack Compiler
Lecture 73 - Jack Compiler
Lecture 74 - Jack Compiler
Lecture 75 - Understand the Operating System - Compiler Interactions
Lecture 76 - Project 12 - One sample journey from Jack to Hack
Lecture 77 - Concluding Remarks
```

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NPTEL Video Course - Computer Science and Engineering - NOC:Machine Learning for Engineering and Science Appl

Subject Co-ordinator - Prof. Ganapathy, Prof. Balaji Srinivasan

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to the Course History of Artificial Intelligence
Lecture 2 - Overview of Machine Learning
Lecture 3 - Why Linear Algebra ? Scalars, Vectors, Tensors
Lecture 4 - Basic Operations
Lecture 5 - Norms
Lecture 6 - Linear Combinations Span Linear Independence
Lecture 7 - Matrix Operations Special Matrices Matrix Decompositions
Lecture 8 - Introduction to Probability Theory Discrete and Continuous Random Variables
Lecture 9 - Conditional, Joint, Marginal Probabilities Sum Rule and Product Rule Bayes' Theorem
Lecture 10 - Bayes' Theorem - Simple Examples
Lecture 11 - Independence Conditional Independence Chain Rule Of Probability
Lecture 12 - Expectation
Lecture 13 - Variance Covariance
Lecture 14 - Some Relations for Expectation and Covariance (Slightly Advanced)
Lecture 15 - Machine Representation of Numbers, Overflow, Underflow, Condition Number
Lecture 16 - Derivatives,Gradient,Hessian,Jacobian,Taylor Series
Lecture 17 - Matrix Calculus (Slightly Advanced)
Lecture 18 - Optimization 1 Unconstrained Optimization
Lecture 19 - Introduction to Constrained Optimization
Lecture 20 - Introduction to Numerical Optimization Gradient Descent - 1
Lecture 21 - Gradient Descent 2 Proof of Steepest Descent Numerical Gradient Calculation Stopping Criteria
Lecture 22 - Introduction to Packages
Lecture 23 - The Learning Paradigm
Lecture 24 - A Linear Regression Example
Lecture 25 - Linear Regression Least Squares Gradient Descent
Lecture 26 - Coding Linear Regression
Lecture 27 - Generalized Function for Linear Regression
Lecture 28 - Goodness of Fit
Lecture 29 - Bias-Variance Trade Off

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Lecture 30 - Gradient Descent Algorithms
Lecture 31 - Introduction to Week 5 (Deep Learning)
Lecture 32 - Logistic Regression
Lecture 33 - Binary Entropy cost function
Lecture 34 - OR Gate Via Classification
Lecture 35 - NOR, AND, NAND Gates
Lecture 36 - XOR Gate
Lecture 37 - Differentiating the sigmoid
Lecture 38 - Gradient of logistic regression
Lecture 39 - Code for Logistic Regression
Lecture 40 - Multinomial Classification - Introduction
Lecture 41 - Multinomial Classification - One Hot Vector
Lecture 42 - Multinomial Classification - Softmax
Lecture 43 - Schematic of multinomial logistic regression
Lecture 44 - Biological neuron
Lecture 45 - Structure of an Artificial Neuron
Lecture 46 - Feedforward Neural Network
Lecture 47 - Introduction to back prop
Lecture 48 - Summary of Week 05
Lecture 49 - Introduction to Convolution Neural Networks (CNN)
Lecture 50 - Types of convolution
Lecture 51 - CNN Architecture Part 1 (LeNet and Alex Net)
Lecture 52 - CNN Architecture Part 2 (VGG Net)
Lecture 53 - CNN Architecture Part 3 (GoogleNet)
Lecture 54 - CNN Architecture Part 4 (ResNet)
Lecture 55 - CNN Architecture Part 5 (DenseNet)
Lecture 56 - Train Network for Image Classification
Lecture 57 - Semantic Segmentation
Lecture 58 - Hyperparameter optimization
Lecture 59 - Transfer Learning
Lecture 60 - Segmentation of Brain Tumors from MRI using Deep Learning
Lecture 61 - Activation Functions
Lecture 62 - Learning Rate decay, Weight initialization
Lecture 63 - Data Normalization
Lecture 64 - Batch Norm
Lecture 65 - Introduction to RNNs
Lecture 66 - Example - Sequence Classification
Lecture 67 - Training RNNs - Loss and BPTT
Lecture 68 - Vanishing Gradients and TBPTT
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Lecture 69 - RNN Architectures
Lecture 70 - LSTM
Lecture 71 - Why LSTM Works
Lecture 72 - Deep RNNs and Bi- RNNs
Lecture 73 - Summary of RNNs
Lecture 74 - Introduction.
Lecture 75 - Knn
Lecture 76 - Binary decision trees
Lecture 77 - Binary regression trees
Lecture 78 - Bagging
Lecture 79 - Random Forest
Lecture 80 - Boosting
Lecture 81 - Gradient boosting
Lecture 82 - Unsupervised learning and Kmeans
Lecture 83 - Agglomerative clustering
Lecture 84 - Probability Distributions- Gaussian, Bernoulli
Lecture 85 - Covariance Matrix of Gaussian Distribution
Lecture 86 - Central Limit Theorem
Lecture 87 - NaÃ Â¯ve Bayes
Lecture 88 - MLE Intro
Lecture 89 - PCA - Part 1
Lecture 90 - PCA - Part 2
Lecture 91 - Support Vector Machines
Lecture 92 - MLE, MAP and Bayesian Regression
Lecture 93 - Introduction to Generative model
Lecture 94 - Generative Adversarial Networks (GAN)
Lecture 95 - Variational Auto-encoders (VAE)
Lecture 96 - Applications
Lecture 97 - Applications
Lecture 98 - Introduction to Week 12
Lecture 99 - Application 1 description - Fin Heat Transfer
Lecture 100 - Application 1 solution
Lecture 101 - Application 2 description - Computational Fluid Dynamics
Lecture 102 - Application 2 solution
Lecture 103 - Application 3 description - Topology Optimization
Lecture 104 - Application 3 solution
Lecture 105 - Application 4 Solution of PDE/ODE using Neural Networks
Lecture 106 - Summary and road ahead
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NPTEL Video Course - Computer Science and Engineering - NOC:Information Security 5 - Secure Systems Engineeri

Subject Co-ordinator - Prof. Chester Rebeiro

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable │ MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Secure Systems Engineering
Lecture 2 - Program Binaries
Lecture 3 - Buffer Overflows in the Stack
Lecture 4 - Buffer Overflows
Lecture 5 - Gdb - Demo
Lecture 6 - Skip instruction - Demo
Lecture 7 - Buffer Overflow - Demo
Lecture 8 - Buffer Overflow (create a shell) - Demo
Lecture 9 - Preventing buffer overflows with canaries and W^X
Lecture 10 - Return-to-libc attack
Lecture 11 - ROP Attacks
Lecture 12 - Demonstration of Canaries, W^X, and ASLR to prevent Buffer Overflow Attacks
Lecture 13 - Demonstration of a Return-to-Libc Attack
Lecture 14 - Demonstration of a Return Oriented Programming (ROP) Attack
Lecture 15 - ASLR - Part 1
Lecture 16 - ASLR - Part 2
Lecture 17 - Buffer overreads
Lecture 18 - Demonstration of Load Time Relocation
Lecture 19 - Demonstration of Position Independent Code
Lecture 20 - PLT Demonstration
Lecture 21 - Format string vulnerabilities
Lecture 22 - Integer Vulnerabilities
Lecture 23 - Heap
Lecture 24 - Heap exploits
Lecture 25 - Demo of Integer Vulnerabilites - I
Lecture 26 - Demo of Integer Vulnerabilites - II
Lecture 27 - Demo of Format String Vulnerabilities
Lecture 28 - Access Control
Lecture 29 - Access control in linux

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Lecture 30 - Mandatory access Control
Lecture 31 - Confinement in Applications
Lecture 32 - Software fault isolation
Lecture 33 - Trusted Execution Environments
Lecture 34 - ARM Trustzone
Lecture 35 - SGX - Part 1
Lecture 36 - SGX - Part 2
Lecture 37 - PUF - Part 1
Lecture 38 - PUF - Part 2
Lecture 39 - PUF - Part 3
Lecture 40 - Covert Channels
Lecture 41 - Flush+Reload Attacks
Lecture 42 - Prime+Probe
Lecture 43 - Meltdown
Lecture 44 - Spectre Variant - 1
Lecture 45 - Spectre variant - 2
Lecture 46 - rowhammer
Lecture 47 - Heap demo - 1
Lecture 48 - Heap demo - 2
Lecture 49 - Heap demo - 3
Lecture 50 - PowerAnalysisAttacks
Lecture 51 - Hardware Trojans
Lecture 52 - FANCI
Lecture 53 - Detecting Hardware Trojans in ICs
Lecture 54 - Protecting against Hardware Trojans
Lecture 55 - Side Channel Analysis
Lecture 56 - Fault Attacks on AES
Lecture 57 - Demo
Lecture 58 - Demo
Lecture 59 - Demo
```

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NPTEL Video Course - Computer Science and Engineering - NOC:Multimodal Interaction

Subject Co-ordinator - Dr. Stefan Hillmann, Prof. Dr. Sebastian Moller

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction
Lecture 2 - Medium vs. Modality
Lecture 3 - Multimedia and Multimodality
Lecture 4 - Modality Relations
Lecture 5 - Characteristics of Multimodal Systems
Lecture 6 - Introduction
Lecture 7 - Speech Production
Lecture 8 - Hearing - Ear
Lecture 9 - Hearing - Perception
Lecture 10 - Introduction
Lecture 11 - The Human Eye
Lecture 12 - Gestlat Perception
Lecture 13 - Resolution and Sensitivity
Lecture 14 - Depth Perception
Lecture 15 - Reading
Lecture 16 - Introduction
Lecture 17 - Haptics
Lecture 18 - Smell
Lecture 19 - Taste
Lecture 20 - Memory
Lecture 21 - Motorsystem
Lecture 22 - Introduction
Lecture 23 - Processing Multiple Signals
Lecture 24 - Multimodal Dual-Tasks
Lecture 25 - Effects of Discongurent Signals
Lecture 26 - Relevance
Lecture 27 - Introduction 1
Lecture 28 - Introduction 2
Lecture 29 - Gesture to Space

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Lecture 30 - Turn Taking
Lecture 31 - Conclusion
Lecture 32 - Introduction
Lecture 33 - Overview
Lecture 34 - Automatic Speech Recognition
Lecture 35 - Emotion Recognition
Lecture 36 - Text Recognition
Lecture 37 - Introduction1
Lecture 38 - Icons
Lecture 39 - Text Generation
Lecture 40 - Text to Speech
Lecture 41 - Speech Generation
Lecture 42 - Introduction .
Lecture 43 - Multimodal Interactive Systems Development
Lecture 44 - Introduction . .
Lecture 45 - Virtual Reality
Lecture 46 - Introduction to Audio for Virtual Reality
Lecture 47 - Spatial Hearing
Lecture 48 - Dummy Heads
Lecture 49 - Individuality of HRTFs
Lecture 50 - Sterophony
Lecture 51 - Crosstalk Cancelation
Lecture 52 - Ambisonics
Lecture 53 - Sound Field Synthesis
Lecture 54 - Challenges with Projection-based Systems
Lecture 55 - Capturing of Sound Scenes
Lecture 56 - Closing Remarks
```

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NPTEL Video Course - Computer Science and Engineering - NOC:Deep Learning - Part 2

Subject Co-ordinator - Prof.Mitesh Khapra

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Recap of Probability Theory
Lecture 2 - Why are we interested in Joint Distributions
Lecture 3 - How do we represent a joint distribution
Lecture 4 - Can we represent the joint distribution more compactly
Lecture 5 - Can we use a graph to represent a joint distribution
Lecture 6 - Different types of reasoning encoded in a Bayesian Network
Lecture 7 - Independencies encoded by a Bayesian Network (Case 1
Lecture 8 - Independencies encoded by a Bayesian Network (Case 2
Lecture 9 - Independencies encoded by a Bayesian Network (Case 3
Lecture 10 - Bayesian Networks
Lecture 11 - I-Maps
Lecture 12 - Markov Networks
Lecture 13 - Factors in Markov Network
Lecture 14 - Local Independencies in a Markov Network
Lecture 15 - Joint Distributions
Lecture 16 - The concept of a latent variable
Lecture 17 - Restricted Boltzmann Machines
Lecture 18 - RBMs as Stochastic Neural Networks
Lecture 19 - Unsupervised Learning with RBMs
Lecture 20 - Computing the gradient of the log likelihood
Lecture 21 - Motivation for Sampling
Lecture 22 - Motivation for Sampling - Part 2
Lecture 23 - Markov Chains
Lecture 24 - Why de we care about Markov Chains ?
Lecture 25 - Setting up a Markov Chain for RBMs
Lecture 26 - Training RBMs Using Gibbs Sampling
Lecture 27 - Training RBMS Using Contrastive Divergence
Lecture 28 - Revisiting Autoencoders
Lecture 29 - Variational Autoencoders

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Lecture 30 - Variational Autoencoders
Lecture 31 - Neural Autoregressive Density Estimator
Lecture 32 - Masked Autoencoder Density Estimator (MADE)
Lecture 33 - Generative Adversarial Networks - The Intuition
Lecture 34 - Generative Adversarial Networks - Architecture
Lecture 35 - Generative Adversarial Networks - The Math Behind it
Lecture 36 - Generative Adversarial Networks - Some Cool Stuff and Applications
Lecture 37 - Bringing it all together (the deep generative summary)
```

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NPTEL Video Course - Computer Science and Engineering - NOC:Machine Learning

Subject Co-ordinator - Prof. Henrik Bostrom, Prof. Fredrik Kilander, Prof. Carl Gustaf Jansson

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to the Machine Learning Course
Lecture 2 - Foundation of Artificial Intelligence and Machine Learning
Lecture 3 - Intelligent Autonomous Systems and Artificial Intelligence
Lecture 4 - Applications of Machine Learning
Lecture 5 - Tutorial for week 1
Lecture 6 - Characterization of Learning Problems
Lecture 7 - Objects, Categories and Features
Lecture 8 - Feature related issues
Lecture 9 - Scenarios for Concept Learning
Lecture 10 - Tutorial for week 2
Lecture 11 - Forms of Representation
Lecture 12 - Decision Trees
Lecture 13 - Bayes (ian) Belief Networks
Lecture 14 - Artificial Neural Networks
Lecture 15 - Genetic algorithm
Lecture 16 - Logic Programming
Lecture 17 - Tutorial for week 3
Lecture 18 - Inductive Learning based on Symbolic Representations and Weak Theories
Lecture 19 - Generalization as Search - Part 1
Lecture 20 - Generalization as Search - Part 2
Lecture 21 - Decision Tree Learning Algorithms - Part 1
Lecture 22 - Decision Tree Learning Algorithms - Part 2
Lecture 23 - Instance Based Learning - Part 1
Lecture 24 - Instance Based Learning - Part 2
Lecture 25 - Cluster Analysis
Lecture 26 - Tutorial for week 4
Lecture 27 - Machine Learning enabled by Prior Theories
Lecture 28 - Explanation Based Learning
Lecture 29 - Inductive Logic Programming

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```
Lecture 30 - Reinforcement Learning - Part 1 Introduction
Lecture 31 - Reinforcement Learning - Part 2 Learning Algorithms
Lecture 32 - Reinforcement Learning - Part 3 Q-Learning
Lecture 33 - Case - Based Reasoning
Lecture 34 - Tutorial for week 5
Lecture 35 - Fundamentals of Artificial Neural Networks - Part 1
Lecture 36 - Fundamentals of Artificial Neural Networks - Part 2
Lecture 37 - Perceptrons
Lecture 38 - Model of Neuron in an ANN
Lecture 39 - Learning in a Feed Forward Multiple Layer ANN - Backpropagation
Lecture 40 - Recurrent Neural Networks
Lecture 41 - Hebbian Learning and Associative Memory
Lecture 42 - Hopfield Networks and Boltzman Machines - Part 1
Lecture 43 - Hopfield Networks and Boltzman Machines - Part 2
Lecture 44 - Convolutional Neural Networks - Part 1
Lecture 45 - Convolutional Neural Networks - Part 2
Lecture 46 - DeepLearning
Lecture 47 - Tutorial for week 6
Lecture 48 - Tools and Resources
Lecture 49 - Interdisciplinary Inspiration
Lecture 50 - Preparation for Exam and Example of Applications
```

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NPTEL Video Course - Computer Science and Engineering - NOC:C Programming and Assembly Language

Subject Co-ordinator - Prof. Janakiraman Viraraghavan

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1
Lecture 2
Lecture 3
Lecture 4
Lecture 5
Lecture 6
Lecture 7
Lecture 8
Lecture 9
Lecture 10
Lecture 11
Lecture 12
Lecture 13
Lecture 14
Lecture 15
Lecture 16
Lecture 17
Lecture 18
Lecture 19
Lecture 20
Lecture 21
Lecture 22

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NPTEL Video Course - Computer Science and Engineering - NOC:Applied Natural Language Processing

Subject Co-ordinator - Prof. Ramaseshan R

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction
Lecture 2 - Operations on a Corpus
Lecture 3 - Probability and NLP
Lecture 4 - Vector Space models
Lecture 5 - Sequence Learning
Lecture 6 - Machine Translation
Lecture 7 - Preprocessing
Lecture 8 - Statistical Properties of Words - Part 1
Lecture 9 - Statistical Properties of Words - Part 2
Lecture 10 - Statistical Properties of Words - Part 3
Lecture 11 - Vector Space Models for NLP
Lecture 12 - Document Similarity - Demo, Inverted index, Exercise
Lecture 13 - Vector Representation of words
Lecture 14 - Contextual understanding of text
Lecture 15 - Co-occurence matrix, n-grams
Lecture 16 - Collocations, Dense word Vectors
Lecture 17 - SVD, Dimensionality reduction, Demo
Lecture 18 - Query Processing
Lecture 19 - Topic Modeling
Lecture 20 - Examples for word prediction
Lecture 21 - Introduction to Probability in the context of NLP
Lecture 22 - Joint and conditional probabilities, independence with examples
Lecture 23 - The definition of probabilistic language model
Lecture 24 - Chain rule and Markov assumption
Lecture 25 - Generative Models
Lecture 26 - Bigram and Trigram Language models - peeking indide the model building
Lecture 27 - Out of vocabulary words and curse of dimensionality
Lecture 28 - Exercise
Lecture 29 - Naive-Bayes, classification

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```
Lecture 30 - Machine learning, perceptron, linearly separable
Lecture 31 - Linear Models for Claassification
Lecture 32 - Biological Neural Network
Lecture 33 - Perceptron
Lecture 34 - Perceptron Learning
Lecture 35 - Logical XOR
Lecture 36 - Activation Functions
Lecture 37 - Gradient Descent
Lecture 38 - Feedforward and Backpropagation Neural Network
Lecture 39 - Why Word2Vec?
Lecture 40 - What are CBOW and Skip-Gram Models?
Lecture 41 - One word learning architecture
Lecture 42 - Forward pass for Word2Vec
Lecture 43 - Matrix Operations Explained
Lecture 44 - CBOW and Skip Gram Models
Lecture 45 - Building Skip-gram model using Python
Lecture 46 - Reduction of complexity - sub-sampling, negative sampling
Lecture 47 - Binay tree, Hierarchical softmax
Lecture 48 - Mapping the output layer to Softmax
Lecture 49 - Updating the weights using hierarchical softmax
Lecture 50 - Discussion on the results obtained from word2vec
Lecture 51 - Recap and Introduction
Lecture 52 - ANN as a LM and its limitations
Lecture 53 - Sequence Learning and its applications
Lecture 54 - Introuduction to Recurrent Neural Network
Lecture 55 - Unrolled RNN
Lecture 56 - RNN - Based Language Model
Lecture 57 - BPTT - Forward Pass
Lecture 58 - BPTT - Derivatives for W,V and U
Lecture 59 - BPTT - Exploding and vanishing gradient
Lecture 60 - LSTM
Lecture 61 - Truncated BPTT
Lecture 62 - GRU
Lecture 63 - Introduction and Historical Approaches to Machine Translation
Lecture 64 - What is SMT?
Lecture 65 - Noisy Channel Model, Bayes Rule, Language Model
Lecture 66 - Translation Model, Alignment Variables
Lecture 67 - Alignments again!
Lecture 68 - IBM Model 1
```

```
Lecture 69 - IBM Model 2
Lecture 70 - Introduction to Phrase-based translation
Lecture 71 - Symmetrization of alignments
Lecture 72 - Extraction of Phrases
Lecture 73 - Learning/estimating the phrase probabilities using another Symmetrization example
Lecture 74 - Introduction to evaluation of Machine Translation
Lecture 75 - BLEU - A short Discussion of the seminal paper
Lecture 76 - BLEU Demo using NLTK and other Metrics
Lecture 77 - Encoder-Decoder model for Neural Machine Translation
Lecture 78 - RNN Based Machine Translation
Lecture 79 - Recap and Connecting Bloom Taxonomy with Machine Learning
Lecture 80 - Introduction to Attention based Translation
Lecture 81 - Research Paper discussion on Neural machine translation by jointly learning to align and transla
Lecture 82 - Typical NMT architecture architecture and models for multi-language translation
Lecture 83 - Beam Search, Stochatic Gradient Descend, Mini Batch, Batch
Lecture 84 - Beam Search, Stochatic Gradient Descend, Mini Batch, Batch
Lecture 85 - Introduction to Conversation Modeling
Lecture 86 - A few examples in Conversation Modeling
Lecture 87 - Some ideas to Implement IR-based Conversation Modeling
Lecture 88 - Discussion of some ideas in Question Answering
Lecture 89 - Hyperspace Analogue to Language - HAL
Lecture 90 - Correlated Occurence Analogue to Lexical Semantic - COALS
Lecture 91 - Global Vectors - Glove
Lecture 92 - Evaluation of Word vectors
```

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NPTEL Video Course - Computer Science and Engineering - NOC:Python for Data Science

Subject Co-ordinator - Prof. Ragunathan Rengasamy

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to Python for Data Science
Lecture 2 - Introduction to Python
Lecture 3 - Introduction to Spyder - Part 1
Lecture 4 - Introduction to Spyder - Part 2
Lecture 5 - Variables and Datatypes
Lecture 6 - Operators
Lecture 7 - Jupyter setup
Lecture 8 - Sequence data - Part 1
Lecture 9 - Sequence data - Part 2
Lecture 10 - Sequence data - Part 3
Lecture 11 - Sequence data - Part 4
Lecture 12 - Numpy
Lecture 13 - Reading data
Lecture 14 - Pandas Dataframes - I
Lecture 15 - Pandas Dataframes - II
Lecture 16 - Pandas Dataframes - III
Lecture 17 - Control structures and Functions
Lecture 18 - Exploratory data analysis
Lecture 19 - Data Visualization - Part I
Lecture 20 - Data Visualization - Part II
Lecture 21 - Dealing with missing data
Lecture 22 - Introduction to Classification Case Study
Lecture 23 - Case Study on Classification - Part I
Lecture 24 - Case Study on Classification - Part II
Lecture 25 - Introduction to Regression Case Study
Lecture 26 - Case Study on Regression - Part I
Lecture 27 - Case Study on Regression - Part II
Lecture 28 - Case Study on Regression - Part III
Lecture 29 - Module : Predictive Modelling

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Lecture 30 - Linear Regression
Lecture 31 - Model Assessment
Lecture 32 - Diagnostics to Improve Linear Model Fit
Lecture 33 - Cross Validation
Lecture 34 - Classification
Lecture 35 - Logistic Regression
Lecture 36 - K-Nearest Neighbors (kNN)
Lecture 37 - K-means Clustering
Lecture 38 - Logistic Regression (Continued...)
Lecture 39 - Decision Trees
Lecture 40 - Multiple Linear Regression
```

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NPTEL Video Course - Computer Science and Engineering - NOC:Practical Machine Learning with Tensorflow

Subject Co-ordinator - Dr. B. Ravindran

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Overview of Tensorflow
Lecture 2 - Machine Learning Refresher
Lecture 3 - Steps in Machine Learning Process
Lecture 4 - Loss Functions in Machine Learning
Lecture 5 - Gradient Descent
Lecture 6 - Gradient Descent Variations
Lecture 7 - Model Selection and Evaluation
Lecture 8 - Machine Learning Visualization
Lecture 9 - Deep Learning Refresher
Lecture 10 - Introduction to Tensors
Lecture 11 - Mathematical Foundations of Deep Learning (Continued...)
Lecture 12 - Building Data Pipelines for Tensorflow - Part 1
Lecture 13 - Building Data Pipelines for Tensorflow - Part 2
Lecture 14 - Building Data Pipelines for Tensorflow - Part 3
Lecture 15 - Text Processing with Tensorflow
Lecture 16 - Classify Images
Lecture 17 - Regression
Lecture 18 - Classify Structured Data
Lecture 19 - Text Classification
Lecture 20 - Underfitting and Overfitting
Lecture 21 - Save and Restore Models
Lecture 22 - CNNs - Part 1
Lecture 23 - CNNs - Part 2
Lecture 24 - Transfer learning with pretrained CNNs
Lecture 25 - Transfer learning with TF hub
Lecture 26 - Image classification and visualization
Lecture 27 - Estimator API
Lecture 28 - Logistic Regression
Lecture 29 - Boosted Trees

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Lecture 30 - Introduction to word embeddings
Lecture 31 - Recurrent Neural Networks - Part 1
Lecture 32 - Recurrent Neural Networks - Part 2
Lecture 33 - Time Series Forecasting with RNNs
Lecture 34 - Text Generation with RNNs
Lecture 35 - TensorFlow Customization
Lecture 36 - Customizing tf.keras - Part 1
Lecture 37 - Customizing tf.keras - Part 2
Lecture 38 - TensorFlow Distributed Training
```

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NPTEL Video Course - Computer Science and Engineering - NOC:Introduction to Database Systems

Subject Co-ordinator - Prof. P.Sreenivasa Kumar

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable


```
Lecture 1  - Introduction
Lecture 2  - Database Architecture
Lecture 3  - RDBMS Architecture
Lecture 4  - Introduction to ER Model
Lecture 5  - Entities and Relationships
Lecture 6  - Modelling Weak Entities and Design Choices
Lecture 7  - Relational Data Model and Notion of Keys
Lecture 8  - Introduction to Relational Algebra
Lecture 9  - Operators in Relational Model
Lecture 10 - Uses of Renaming, Join and Division in Relation Algebra
Lecture 11 - Example Queries in Relation Model and Outer Join Operation
Lecture 12 - Convert ER-Model to a Relational Model
Lecture 13 - Introduction to tuple relational calculus
Lecture 14 - Example TRC queries
Lecture 15 - Data definition using SQL
Lecture 16 - Basic SQL query block and subqueries
Lecture 17 - Correlated subqueries
Lecture 18 - Aggregate functions
Lecture 19 - Views
Lecture 20 - Programmatic access of SQL
Lecture 21 - Normal forms - Introduction
Lecture 22 - Deriving new functional dependencies
Lecture 23 - Proving soundness and completeness of Armstrong's Axioms
Lecture 24 - Normal forms - 2 NF, 3NF, BCNF
Lecture 25 - Properties of decompositions
Lecture 26 - Normal forms - 4NF, 5NF
Lecture 27 - Introduction to file orgranization
Lecture 28 - File orgranization methods
Lecture 29 - Dynamic File orgranization using Hashing
```

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```
Lecture 30 - Index structures
Lecture 31 - B+ trees on Disks
Lecture 32 - Performance and Reliability of Multiple Disks
Lecture 33 - Relational Query Evaluation
Lecture 34 - Join operator processing algorithms
Lecture 35 - Query optimization
Lecture 36 - ACID properties and operations in transactions
Lecture 37 - Schdeules
Lecture 38 - Concurrency control using Locks
Lecture 39 - Recovery using undo logging method
Lecture 40 - Recovery using Redo and Undo-Redo logging methods
Lecture 41 - Recoverable schdeules and transaction isolation levels
```

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NPTEL Video Course - Computer Science and Engineering - NOC:Foundations of Cryptography

Subject Co-ordinator - Prof. Ashish Choudhury

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction
Lecture 2 - Symmetric-key Encryption
Lecture 3 - Historical Ciphers and their Cryptanalysis
Lecture 4 - Perfect Security
Lecture 5 - Limitations of Perfect Security
Lecture 6 - Introduction to Computational Security
Lecture 7 - Semantic Security
Lecture 8 - Pseudo-random Generators (PRGs)
Lecture 9 - Operations on Pseudorandom Generators
Lecture 10 - Stream Ciphers
Lecture 11 - Provably-secure Instantiation of PRG
Lecture 12 - Practical Instantiations of PRG
Lecture 13 - CPA-security
Lecture 14 - Pseudo-random Functions (PRFs)
Lecture 15 - CPA-secure Encryption from PRF
Lecture 16 - Modes of Operations of Block Ciphers - Part I
Lecture 17 - Modes of Operations of Block Ciphers - Part II
Lecture 18 - Theoretical Constructions of Block Ciphers
Lecture 19 - Practical Constructions of Block Ciphers - Part I
Lecture 20 - Practical Constructions of Block Ciphers - Part II
Lecture 21 - From Passive to Active Adversary
Lecture 22 - Message Integrity and Authentication
Lecture 23 - Message Authentication for Long Messages - Part I
Lecture 24 - Message Authentication for Long Messages - Part II
Lecture 25 - Information-theoretic MACs - Part I
Lecture 26 - Information-theoretic MACs - Part II
Lecture 27 - Cryptographic Hash Functions - Part I
Lecture 28 - Cryptographic Hash Functions - Part II
Lecture 29 - Message Authentication Using Hash Functions

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Lecture 30 - Generic Attacks on Hash Functions and Additional Applications of Hash Functions
Lecture 31 - Random Oracle Model - Part I
Lecture 32 - Random Oracle Model - Part II
Lecture 33 - Authenticated Encryption
Lecture 34 - Composing CPA-secure Cipher with a Secure MAC - Part I
Lecture 35 - Composing CPA-secure Cipher with a Secure MAC - Part II
Lecture 36 - Key-Exchange Protocols - Part I
Lecture 37 - Key-Exchange Protocols - Part II
Lecture 38 - Cyclic groups
Lecture 39 - Cryptographic Hardness Assumptions in the Cyclic Groups
Lecture 40 - Candidate Cyclic Groups for Cryptographic Purposes - Part I
Lecture 41 - Candidate Cyclic Groups for Cryptographic Purposes - Part II
Lecture 42 - Cryptographic Applications of the Discrete Log Assumption
Lecture 43 - Public-key Encryption
Lecture 44 - El Gamal Public-key Encryption Scheme
Lecture 45 - RSA Assumption
Lecture 46 - RSA Public-key Cryptosystem
Lecture 47 - Hybrid Public-key Cryptosystem
Lecture 48 - CCA-Secure Public-key Ciphers
Lecture 49 - CCA-Secure Public-key Ciphers Based on Diffie-Hellman Problems
Lecture 50 - CCA-Secure Public-key Ciphers Based on RSA Assumption
Lecture 51 - Digital Signatures
Lecture 52 - RSA Signatures
Lecture 53 - Identification Schemes
Lecture 54 - Schnorr Signature Scheme and TLS/SSL
Lecture 55 - Number Theory
Lecture 56 - Secret Sharing
Lecture 57 - Zero-Knowledge Protocols - Part I
Lecture 58 - Zero-Knowledge Protocols - Part II
Lecture 59 - Good Bye for Now
```

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NPTEL Video Course - Computer Science and Engineering - NOC:Modern Application Development

Subject Co-ordinator - Prof. Madhavan Mukund, Prof. Abhijat Vichare, Prof. Aamod Sane

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to Modern Application Development - Part 1
Lecture 2 - Introduction to Modern Application Development - Part 2
Lecture 3 - Introduction to Modern Application Development - Part 3
Lecture 4 - Introduction to Modern Application Development - Part 4
Lecture 5 - Introduction to Modern Application Development - Part 5
Lecture 6 - Command Line - Part 1
Lecture 7 - Command Line - Part 2
Lecture 8 - Command Line - Practice Questions - Part 1
Lecture 9 - Command Line - Practice Questions - Part 2
Lecture 10 - Comparing CLI, GUI, and Web Interfaces
Lecture 11 - Producing HTML+CSS output - Part 1
Lecture 12 - Producing HTML+CSS output - Part 2
Lecture 13 - Introduction to Input in HTML
Lecture 14 - Session 2 - Part 1
Lecture 15 - Session 2 - Part 2
Lecture 16 - Session 2 - Part 3
Lecture 17 - Session 1 - Part 1 - Introduction to HTML and CSS
Lecture 18 - Session 1 - Part 2
Lecture 19 - Week6 - Session 1
Lecture 20 - Week6 - Session 2
Lecture 21 - Introduction to JDBC
Lecture 22 - Week 7 Session 1 - Part 1
Lecture 23 - Week 7 Session 1 - Part 2
Lecture 24 - Week 8 Session 1
Lecture 25 - Week 8 Session 2
Lecture 26 - Week 8 Session 3
Lecture 27 - Week 9 Session 1
Lecture 28 - Week 9 Session 3
Lecture 29 - Week 10 Part 1

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Lecture 30 - Week 10 Part 2
Lecture 31 - Week 10 Part 3

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NPTEL Video Course - Computer Science and Engineering - NOC:Deep Learning for Computer Vision

Subject Co-ordinator - Prof. Vineeth N Balasubramanian

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Course Introduction
Lecture 2 - History
Lecture 3 - Image Formation
Lecture 4 - Image Representation
Lecture 5 - Linear Filtering
Lecture 6 - Image in Frequency Domain
Lecture 7 - Image Sampling
Lecture 8 - Edge Detection
Lecture 9 - From Edges to Blobs and Corners
Lecture 10 - Scale Space, Image Pyramids and Filter Banks
Lecture 11 - Feature Detectors
Lecture 12 - Image Segmentation
Lecture 13 - Other Feature Spaces
Lecture 14 - Human Visual System
Lecture 15 - Feature Matching
Lecture 16 - Hough Transform
Lecture 17 - From Points to Images
Lecture 18 - Image Descriptor Matching
Lecture 19 - Pyramid Matching
Lecture 20 - From Traditional Vision to Deep Learning
Lecture 21 - Neural Networks
Lecture 22 - Neural Networks
Lecture 23 - Feedforward Neural Networks and Backpropagation - Part 1
Lecture 24 - Feedforward Neural Networks and Backpropagation - Part 2
Lecture 25 - Gradient Descent and Variants - Part 1
Lecture 26 - Gradient Descent and Variants - Part 2
Lecture 27 - Regularization in Neural Networks - Part 1
Lecture 28 - Regularization in Neural Networks - Part 2
Lecture 29 - Improving Training of Neural Networks - Part 1

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Lecture 30 - Improving Training of Neural Networks - Part 2
Lecture 31 - Convolutional Neural Networks
Lecture 32 - Convolutional Neural Networks
Lecture 33 - Backpropagation in CNNs
Lecture 34 - Evolution of CNN Architectures for Image Classification - Part 1
Lecture 35 - Evolution of CNN Architectures for Image Classification - Part 2
Lecture 36 - Recent CNN Architectures
Lecture 37 - Finetuning in CNNs
Lecture 38 - Explaining CNNs
Lecture 39 - Explaining CNNs
Lecture 40 - Explaining CNNs
Lecture 41 - Explaining CNNs
Lecture 42 - Explaining CNNs
Lecture 43 - Going Beyond Explaining CNNs
Lecture 44 - CNNs for Object Detection-I - Part 1
Lecture 45 - CNNs for Object Detection-I - Part 2
Lecture 46 - CNNs for Object Detection-II
Lecture 47 - CNNs for Segmentation
Lecture 48 - CNNs for Human Understanding
Lecture 49 - CNNs for Human Understanding
Lecture 50 - CNNs for Human Understanding
Lecture 51 - CNNs for Other Image Tasks
Lecture 52 - Recurrent Neural Networks
Lecture 53 - Backpropagation in RNNs
Lecture 54 - LSTMs and GRUs
Lecture 55 - Video Understanding using CNNs and RNNs
Lecture 56 - Attention in Vision Models
Lecture 57 - Vision and Language
Lecture 58 - Beyond Captioning
Lecture 59 - Other Attention Models
Lecture 60 - Self-Attention and Transformers
Lecture 61 - Deep Generative Models
Lecture 62 - Generative Adversarial Networks - Part 1
Lecture 63 - Generative Adversarial Networks - Part 2
Lecture 64 - Variational Autoencoders
Lecture 65 - Combining VAEs and GANs
Lecture 66 - Beyond VAEs and GANs
Lecture 67 - Beyond VAEs and GANs
Lecture 68 - GAN Improvements
```

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Lecture 69 - Deep Generative Models across Multiple Domains
Lecture 70 - VAEs and DIsentanglement
Lecture 71 - Deep Generative Models
Lecture 72 - Deep Generative Models
Lecture 73 - Few-shot and Zero-shot Learning - Part 1
Lecture 74 - Few-shot and Zero-shot Learning - Part 2
Lecture 75 - Self-Supervised Learning
Lecture 76 - Adversarial Robustness
Lecture 77 - Pruning and Model Compression
Lecture 78 - Neural Architecture Search
Lecture 79 - Course Conclusion
```

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NPTEL Video Course - Computer Science and Engineering - NOC:Artificial Intelligence Search Methods For Proble

Subject Co-ordinator - Prof. Deepak Khemani

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Prologue
Lecture 2 - The Winograd Schema Challenge
Lecture 3 - Introduction (2013 version)
Lecture 4 - Can Machines Think?
Lecture 5 - The Turing Test
Lecture 6 - Language and Thought
Lecture 7 - The Willing Suspension of Disbelief
Lecture 8 - Machines with Wheels and Gears
Lecture 9 - The Notion of Mind in Philosophy
Lecture 10 - Reasoning = Computation
Lecture 11 - Concepts and Categories
Lecture 12 - How did AI get its name?
Lecture 13 - The Chess Saga
Lecture 14 - A Brief History of AI
Lecture 15 - The Worlds in our Minds
Lecture 16 - Epiphemona in Computers
Lecture 17 - State Space Search
Lecture 18 - Domain Independent Algorithms
Lecture 19 - Deterministic Search
Lecture 20 - DFS and BFS
Lecture 21 - Comparing DFS and BFS
Lecture 22 - Depth First Iterative Deepening
Lecture 23 - Heuristic Search
Lecture 24 - Heuristic Functions and the Search Landscape
Lecture 25 - Solution Space Search
Lecture 26 - The Traveling Salesman Problem
Lecture 27 - Escaping Local Optima
Lecture 28 - Stochastic Local Search
Lecture 29 - Genetic Algorithms

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Lecture 30 - Genetic Algorithms and SAT
Lecture 31 - Genetic Algorithms for the TSP
Lecture 32 - Emergent Systems
Lecture 33 - Ant Colony Optimization
Lecture 34 - Finding Optimal Paths
Lecture 35 - Branch and Bound
Lecture 36 - Algorithm A*
Lecture 37 - A*
Lecture 38 - Is A* Admissible?
Lecture 39 - Admissibility of A*
Lecture 40 - Higher, Faster ...
Lecture 41 - B&B - A* - wA* - Best First
Lecture 42 - A*
Lecture 43 - The Monotone Condition
Lecture 44 - DNA Sequence Alignment
Lecture 45 - Divide and Conquer Frontier Search.
Lecture 46 - Smart Memory Graph Search
Lecture 47 - Variations on A*
Lecture 48 - Breadth First Heuristic Search
Lecture 49 - Beam Stack Search
Lecture 50 - Game Theory
Lecture 51 - Popular Recreational Games
Lecture 52 - Board Games and Game Trees
Lecture 53 - The Evaluation Function in Board Games
Lecture 54 - Algorithm Minimax and Alpha-Beta Pruning
Lecture 55 - A Cluster of Strategies
Lecture 56 - SSS*
Lecture 57 - SSS*
Lecture 58 - Automated Domain Independent Planning
Lecture 59 - The Blocks World Domain
Lecture 60 - State Space Planning
Lecture 61 - Goal Stack Planning (GSP)
Lecture 62 - GSP
Lecture 63 - Plan Space Planning (PSP)
Lecture 64 - PSP
Lecture 65 - Multi-Armed Robots
Lecture 66 - Means-Ends Analysis
Lecture 67 - The Planning Graph
Lecture 68 - Algorithm Graphplan
```

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Lecture 69 - Problem Decomposition.
Lecture 70 - Algorithm AO*
Lecture 71 - AO*
Lecture 72 - Rule Based Expert Systems
Lecture 73 - The Inference Engine
Lecture 74 - The OPS5 Language
Lecture 75 - Conflict Resolution
Lecture 76 - Business Rule Management Systems
Lecture 77 - The Rete Net
Lecture 78 - Rete Algorithm
Lecture 79 - Rete Algorithm
Lecture 80 - Reasoning in Logic
Lecture 81 - Rules of Inference
Lecture 82 - Forward Reasoning
Lecture 83 - First Order Logic
Lecture 84 - Implicit Quantifier Notation
Lecture 85 - Backward Reasoning
Lecture 86 - Depth First Search on Goal Trees
Lecture 87 - Incompleteness...
Lecture 88 - Constraint Satisfaction Problems
Lecture 89 - Binary Constraint Networks
Lecture 90 - Interpreting Line Drawings
Lecture 91 - Model Based Diagnosis
Lecture 92 - Solving CSPs
Lecture 93 - Arc Consistency
Lecture 94 - Propagation = Reasoning
Lecture 95 - Lookahead Search
```

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NPTEL Video Course - Computer Science and Engineering - NOC:Computational Complexity

Subject Co-ordinator - Prof. Subrahmanyam Kalyanasundaram

Co-ordinating Institute - IIT - Hyderabad

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to Computational Complexity
Lecture 2 - The Class P
Lecture 3 - The Class NP
Lecture 4 - The Class NP - Alternate Definition
Lecture 5 - Polynomial Time Reductions
Lecture 6 - NP - Completeness
Lecture 7 - Cook Levin Theorem - Part 1
Lecture 8 - Cook Levin Theorem - Part 2
Lecture 9 - More NP Complete Problems
Lecture 10 - Polynomial Hierarchy - Part 1
Lecture 11 - Polynomial Hierarchy - Part 2
Lecture 12 - Polynomial Hierarchy - Part 3
Lecture 13 - Time Hierarchy Theorem
Lecture 14 - Introduction to Space Complexity
Lecture 15 - NL-Completeness
Lecture 16 - Savitch's Theorem
Lecture 17 - NL = co-NL - Part 1
Lecture 18 - NL = co-NL - Part 2
Lecture 19 - PSPACE Completeness
Lecture 20 - Games and PSPACE Completeness
Lecture 21 - Space Hierarchy Theorem
Lecture 22 - Ladner's Theorem
Lecture 23 - Oracle Turing Machines
Lecture 24 - Polynomial Hierarchy Using Oracles
Lecture 25 - Baker-Gill-Solovay Theorem - Part 1
Lecture 26 - Baker-Gill-Solovay Theorem - Part 2
Lecture 27 - Randomized Complexity Classes - Part 1
Lecture 28 - Randomized Complexity Classes - Part 2
Lecture 29 - Randomized Complexity Classes - Part 3

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Lecture 30 - Randomized Complexity Classes - Part 4
Lecture 31 - Comparison Between Randomized Complexity Classes
Lecture 32 - BPP is in Polynomial Hierarchy
Lecture 33 - Circuit Complexity - Part 1
Lecture 34 - Circuit Complexity - Part 2
Lecture 35 - Formal Definition of Circuits
Lecture 36 - Hierarchy Theorem for Circuit Size
Lecture 37 - Complexity Class : P/Poly
Lecture 38 - Karp-Lipton Theorem
Lecture 39 - Turing Machines That Take Advice
Lecture 40 - Classes NC and AC
Lecture 41 - Parity Not in AC0 - Part 1
Lecture 42 - Parity Not in AC0 - Part 2
Lecture 43 - Adleman's Theorem
Lecture 44 - Polynomial Identity Testing and Bipartite Perfect Matching in RNC
Lecture 45 - Search Bipartite Perfect Matching is in RNC - Part 1
Lecture 46 - Search Bipartite Perfect Matching is in RNC - Part 2
Lecture 47 - Promise Problems and Valiant-Vazirani Theorem
Lecture 48 - Valiant Vazirani Theorem Continued
Lecture 49 - #P and the Complexity of Counting
Lecture 50 - Permanent is #P-Complete - Part 1
Lecture 51 - Permanent is #P-Complete - Part 2
Lecture 52 - Toda's Theorem - Part 1
Lecture 53 - Toda's Theorem - Part 2
Lecture 54 - Introduction to Communication Complexity - Part 1
Lecture 55 - Introduction to Communication Complexity - Part 2
Lecture 56 - Lower Bound Techniques
Lecture 57 - Communication Complexity of Relations
Lecture 58 - Monotone Depth Lower Bound for Matching
Lecture 59 - Interactive Proofs
Lecture 60 - #3SAT is in IP
Lecture 61 - Public Coin Interactive Proofs and AM/MA
Lecture 62 - Simulating Private Coins using Public Coins
Lecture 63 - Summary and Concluding Remarks
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NPTEL Video Course - Computer Science and Engineering - NOC:Parameterized Algorithms

Subject Co-ordinator - Prof. Neeldhara Misra

Co-ordinating Institute - IIT Gandhinagar, IMSC

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Invitation to FPT
Lecture 2 - Formalizing FPT
Lecture 3 - Kernelization: High Degree Rule
Lecture 4 - Kernelization: d-Hitting Set
Lecture 5 - Kernelization: Crown Reduciton
Lecture 6 - Kernelization: Nemhauser-Trotter and Expansion Lemma
Lecture 7 - Introduction to Branching
Lecture 8 - Analyzing Recurrences
Lecture 9 - High-Degree Branching for FVS
Lecture 10 - Vertex Cover above LP
Lecture 11 - Applications of Vertex Cover above Matching
Lecture 12 - Iterative Compression I: Setting Up the Method
Lecture 13 - Iterative Compression II: Vertex Cover and Tournament Feedback Vertex Set
Lecture 14 - Iterative Compression III: Feedback Vertex Set and 3-Hitting Set
Lecture 15 - Iterative Compression IV: Odd Cycle Transversal
Lecture 16 - Introduction to Randomized Algorithms via a Simple Randomized FPT Algorithm for FVS
Lecture 17 - Color Coding for Longest Path
Lecture 18 - Chromatic Coding for Feedback Arc Set on Tournaments
Lecture 19 - Random Separation and Subgraph Isomorphism
Lecture 20 - Derandomization
Lecture 21 - Divide and Conquer and Separator
Lecture 22 - Towards Defining Treewidth
Lecture 23 - Treewidth and Constructing Treedecomposition of Few Graph Classes
Lecture 24 - Structural Properties of Treedecomposition and Win-Win
Lecture 25 - Nice Tree Decomposition and Algorithm for Max Weight Independent Set
Lecture 26 - Dynamic Programming Algorithm over graphs of Bounded Treewidth
Lecture 27 - FPT Appproximation Algorithm for Computing Tree Decomposition - Part 1
Lecture 28 - FPT Appproximation Algorithm for Computing Tree Decomposition - Part 2
Lecture 29 - FPT Appproximation Algorithm for Computing Tree Decomposition and Applications - Part 1

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Lecture 30 - FPT Appproximation Algorithm for Computing Tree Decomposition and Applications - Part 2
Lecture 31 - Dynamic Programming Over Subsets for Set Cover
Lecture 32 - Dynamic Programming Over Subsets for Steiner Tree
Lecture 33 - ILP for Envy-Free Allocations and Lobbying
Lecture 34 - ILP for Imbalance Parameterized by Vertex Cover
Lecture 35 - Important Cuts: Basic
Lecture 36 - Important Cuts: Enumeration and Bounds
Lecture 37 - FPT Algorithm for Multiway Cut
Lecture 38 - FPT Algorithm for Directed Feedback Edge Set
Lecture 39 - Algebraic Techniques: Inclusion Exclusion (Coloring)
Lecture 40 - Algebraic Techniques: Inclusion Exclusion (Hamiltonian Path)
Lecture 41 - Algebraic Techniques: Matrix Multiplication
Lecture 42 - Algebraic Techniques: Polynomial Method
Lecture 43 - Matroids: Representative Sets
Lecture 44 - Matroids: Representative Sets - Computation and Combinatorics
Lecture 45 - Matroids: Representative Sets - Applications (Paths and Kernels)
Lecture 46 - Matroids: Representative Sets - Applications (Directed Long Cycle)
Lecture 47 - Reductions - An Introduction
Lecture 48 - Reductions - Problems as Hard as Clique I (Clique on Regular Graphs)
Lecture 49 - Reductions - Problems as Hard as Clique (PVC, MCC, MIS)
Lecture 50 - Reductions - Problems as Hard as Clique (Dominating Set, Set Cover)
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NPTEL Video Course - Computer Science and Engineering - NOC:Getting Started with Competitive Programming

Subject Co-ordinator - Prof. Neeldhara Misra

Co-ordinating Institute - IIT - Gandhinagar

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 0 - Welcome and Initial Setup
Lecture 1 - Reversort
Lecture 2 - Engineering Reversort
Lecture 3 - Number Game
Lecture 4 - Will It Stop?
Lecture 5 - Trouble Sort
Lecture 6 - The Meeting Place Cannot Be Changed
Lecture 7 - Magic Ship
Lecture 8 - Simple Skewness
Lecture 9 - Pancake Flipping
Lecture 10 - Islands War
Lecture 11 - Stable Marriage - I
Lecture 12 - Stable Marriage - II
Lecture 13 - When Greedy Does Not Work - Coin Change
Lecture 14 - When Greedy Does Not Work - Guarding a Museum
Lecture 15 - When Greedy Does Not Work - Traveling Salesman
Lecture 16 - DSU - Definition and Motivation
Lecture 17 - DSU via Union by Rank and Path Compression
Lecture 18 - DSU - Implementation
Lecture 19 - Destroying Array - I (Problem Statement and Solution)
Lecture 20 - Destroying Array - II (Implementation)
Lecture 21 - War-I (Problem Statement)
Lecture 22 - War-II (Solution)
Lecture 23 - War-III (Implementation)
Lecture 24 - Graph Foundations
Lecture 25 - BFS and DFS
Lecture 26 - Mahmoud and Ehab and the bipartiteness
Lecture 27 - Cover It!
Lecture 28 - Diamond Inheritance

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Lecture 29 - SSSP - Overview BFS Revisited
Lecture 30 - SSSP and Dijkstra's Algorithm
Lecture 31 - Sending Email
Lecture 32 - SSSP and Modified Dijkstra
Lecture 33 - SSSP with Negative Cycles - Bellman-Ford
Lecture 34 - Wormholes
Lecture 35 - APSP and Floyd-Warshall
Lecture 36 - Page Hopping
Lecture 37 - Introduction to MSTs
Lecture 38 - Prim's Algorithm
Lecture 39 - Kruskal's Algorithm
Lecture 40 - Cherries Mesh
Lecture 41 - Heirarchy
Lecture 42 - Island Hopping
Lecture 43 - Introduction to MaxFlow
Lecture 44 - Ford-Fulkerson for MaxFlow
Lecture 45 - Implementing Edmonds-Karp
Lecture 46 - Maximum Matching via MaxFlow
Lecture 47 - Sport Elimination via MaxFlow
Lecture 48 - Maxflow-Mincut Duality
Lecture 49 - Police Chase
Lecture 50 - Sam I AM and Vertex Covers
Lecture 51 - Top-Down Dynamic Programming with Frog 1 - Part A
Lecture 52 - Top-Down Dynamic Programming with Frog 1 - Part B
Lecture 53 - Bottom-Up Dynamic Programming with Dice Combinations
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NPTEL Video Course - Computer Science and Engineering - NOC:Introduction to Quantum Computing: Quantum Algori

Subject Co-ordinator - Prof. Prabha Mandayam

Co-ordinating Institute - IBM and IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Quantum Computing Roadmap
Lecture 2 - Quantum Mission in India
Lecture 3 - A Brief Introduction to Applications of Quantum
Lecture 4 - Quantum Computing Basics
Lecture 5 - Postulates of Quantum Mechanics - Part 1
Lecture 6 - Postulates of Quantum Mechanics - Part 2
Lecture 7 - Quantum Measurements
Lecture 8 - Quantum Gates and Circuits - Part 1
Lecture 9 - Quantum Gates and Circuits - Part 2
Lecture 10 - Programming using IBM Quantum Experience and Circuit Composer
Lecture 11 - Quantum Computing Concepts: Entanglement and Interferenceâ - Part 1
Lecture 12 - Quantum Computing Concepts: Entanglement and Interferenceâ - Part 2
Lecture 13 - Programming using Qiskit - Part 1
Lecture 14 - Programming using Qiskit - Part 2
Lecture 15 - Quantum Algorithms: Deutsch Jozsa Algorithm
Lecture 16 - Quantum Algorithms: Bernstein Vazirani Algorithm
Lecture 17 - Quantum Algorithms: Grover's Search
Lecture 18 - Grover's algorithm Programming
Lecture 19 - NISQ-era quantum algorithms
Lecture 20 - Variational Quantum Algorithms
Lecture 21 - Variational Quantum Eigensolver
Lecture 22 - Quantum Generative Adversarial Networks (QGANs)
Lecture 23 - Fixing quantum errors with quantum tricks: A brief introduction to QEC - Part 1
Lecture 24 - Fixing quantum errors with quantum tricks: A brief introduction to QEC - Part 2
Lecture 25 - Fixing quantum errors with quantum tricks: A brief introduction to QEC - Part 3

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NPTEL Video Course - Computer Science and Engineering - NOC:Systems and Usable Security

Subject Co-ordinator - Prof. Neminath Hubballi

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to Computer Security - Part 1
Lecture 2 - Introduction to Computer Security - Part 2
Lecture 3 - Malcious Software - Part 1
Lecture 4 - Malcious Software - Part 2
Lecture 5 - Social Engineering and Phishing Attacks - Part 1
Lecture 6 - Social Engineering and Phishing Attacks - Part 2
Lecture 7 - Operating System Security - Part 1
Lecture 8 - Operating System Security - Part 2
Lecture 9 - Operating System Security - Part 3
Lecture 10 - Operating System Security - Part 4
Lecture 11 - Email Security - Part 1
Lecture 12 - Email Security - Part 2
Lecture 13 - Transport Layer Security - Part 1
Lecture 14 - Transport Layer Security - Part 2
Lecture 15 - IP Security - Part 1
Lecture 16 - IP Security - Part 2
Lecture 17 - Security and Usability Overview
Lecture 18 - User Privacy and Usability

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NPTEL Video Course - Computer Science and Engineering - NOC:Online Privacy

Subject Co-ordinator - Prof. Ponnurangam Kumaraguru

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Online Privacy
Lecture 2 - Privacy concepts and studies
Lecture 3 - Fair Information Practices
Lecture 4 - Right to Privacy Contextual Integrity
Lecture 5 - Privacy Policy - Part I
Lecture 6 - Privacy Policy - Part II
Lecture 7 - Privacy-based technologies and decision making
Lecture 8 - Social Media Privacy
Lecture 9 - Identity resolution
Lecture 10 - Privacy Nudges
Lecture 11 - Cookies
Lecture 12 - Ethics about studying Online Privacy
Lecture 13 - Anonymization techniques and Differential Privacy
Lecture 14 - Conducting (user, lab, online) studies
Lecture 15 - Research paper reading
Lecture 16 - Voter and Browser Privacy Leaks, Profiling form PII - Part I
Lecture 17 - Voter and Browser Privacy Leaks, Profiling form PII - Part II
Lecture 18 - Online Privacy Tools (Hands-on) - Part I
Lecture 19 - Online Privacy Tools (Hands-on) - Part II
Lecture 20 - Mobile numbers, home location, Location-based social networks
Lecture 21 - Location-based social networks
Lecture 22 - Privacy laws and regulations - Part I
Lecture 23 - Privacy laws and regulations - Part II
Lecture 24 - Privacy standards
Lecture 25 - Look back

NPTEL Video Course - Computer Science and Engineering - NOC:Introduction to Machine Learning (Tamil)

Subject Co-ordinator - Prof. Arun Rajkumar

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Paradigms of Machine Learning
Lecture 2 - Few more examples
Lecture 3 - Types of Learning
Lecture 4 - Types of supervised learning
Lecture 5 - Mathematical tools
Lecture 6 - Three Fundamental spaces
Lecture 7 - Conditional Probability
Lecture 8 - Bayes Theorem
Lecture 9 - Continuous Probability
Lecture 10 - Introduction to vectors
Lecture 11 - Span of vectors
Lecture 12 - Linear Independence
Lecture 13 - Basis of vector space
Lecture 14 - Orthogonality and Projection
Lecture 15 - Introduction to Regression
Lecture 16 - Linear regression
Lecture 17 - Geometrical Interpretation
Lecture 18 - Visual Guide to Orthogonal Projection
Lecture 19 - Iterative solution: Gradient descent
Lecture 20 - Gradient Descent
Lecture 21 - Choosing Step size
Lecture 22 - Taylor Series
Lecture 23 - Stochastic Gradient Descent and basis functions
Lecture 24 - Regularization Techniques
Lecture 25 - Binary Classification
Lecture 26 - K-Nearest Neighbour Classification
Lecture 27 - Distance metric and Cross-Validation
Lecture 28 - Computational efficiency of KNN
Lecture 29 - Introduction to Decision Trees

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Lecture 30 - Level splitting
Lecture 31 - Measure of Impurity
Lecture 32 - Entropy and Information Gain
Lecture 33 - Generative vs Discriminative models
Lecture 34 - Naive Bayes classifier
Lecture 35 - Conditional Independence
Lecture 36 - Classifying the test point and summary
Lecture 37 - Discriminative models
Lecture 38 - Logistic Regression
Lecture 39 - Summary and big picture
Lecture 40 - Maximum likelihood estimation
Lecture 41 - Linear separability
Lecture 42 - Perceptron and its learning algorithm
Lecture 43 - Perceptron : A thing of past
Lecture 44 - Support Vector Machine
Lecture 45 - Optimizing weights
Lecture 46 - Handling Outliers
Lecture 47 - Dual Formulation
Lecture 48 - Kernel formulation
Lecture 49 - Introduction to Ensemble methods
Lecture 50 - Bagging
Lecture 51 - Bootstrapping
Lecture 52 - Limitations of bagging
Lecture 53 - Introduction to boosting
Lecture 54 - Ada boost
Lecture 55 - Unsupervised learning
Lecture 56 - K-means Clustering
Lecture 57 - LLyod's Algorithms
Lecture 58 - Convergence and Initialization
Lecture 59 - Representation Learning
Lecture 60 - Orthogonal Projection
Lecture 61 - Covariance Matrix and Eigen direction
Lecture 62 - PCA and mean centering
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NPTEL Video Course - Computer Science and Engineering - Compiler Design (Prof. Rupesh Nasre)

Subject Co-ordinator - Prof. Rupesh Nasre

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction - Part 1, Programming languages and compilers
Lecture 2 - Introduction - Part 2, Language translators
Lecture 3 - Introduction - Part 3, Phases of a compiler
Lecture 4 - Introduction - Part 4, Static vs Dynamic contexts,Parameter passing
Lecture 5 - Lexing - Part 1, Terminology, Regex, flex tool- Part 1
Lecture 6 - Lexing - Part 2, Lexical errors, Input buffering
Lecture 7 - flex tool- Part 2
Lecture 8 - Lexing - Part 3, Lookahead, KMP string matching
Lecture 9 - Lexing - Part 4, Regex to DFA conversion - Part 1
Lecture 10 - Lexing - Part 5, Regex to DFA conversion - Part 2, Prasing - Part 1
Lecture 11 - Parsing - Part 2, CFG, Parse tree, Precedence, Ambiguity
Lecture 12 - flex tool - Part 3
Lecture 13 - Parsing - Part 3, Sentinel forms, Error recovery, if-else ambiguity
Lecture 14 - Parsing - Part 4, Left recursion, Recursive descent parsing
Lecture 15 - Parsing - Part 5, First and Follow, Predicitive parsing table
Lecture 16 - Parsing - Part 6, Predictive parsing table, LL(1) grammars
Lecture 17 - Discussions and doubts clarification - Part 1
Lecture 18 - Parsing - Part 6, Bottom-up, Shift-reduce parsing, SLR parsing
Lecture 19 - Parsing - Part 6, LR(0) automaton, SLR parsing using automaton
Lecture 20 - Parsing - Part 7, SLR(1) parsing table, SLR(1) parsing algorithm
Lecture 21 - Parsing - Part 8, Viable prefixes, LR(1) parsing, LR(1) automaton
Lecture 22 - Parsing - Part 9, LALR parsing, SDT- Part 1, attributes
Lecture 23 - Syntax Directed Translation - Part 2, S- and L-attributed SDD
Lecture 24 - Syntax Directed Translation - Part 3, L-attributed SDD, Applications
Lecture 25 - Syntax Directed Translation - Part 4, Actions within productions
Lecture 26 - Discussions and doubts clarification - Part 2
Lecture 27 - Quiz-1 discussion, SDT - Part 5, Code generation for while loop
Lecture 28 - Intermdiate Code Generation - Part 1, Syntax trees and DAGs
Lecture 29 - Intermdiate Code Generation - Part 2, Three-address code

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Lecture 30 - Discussions and doubts clarification Part 3
Lecture 31 - Intermdiate Code Generation - Part 3, Static single assignment
Lecture 32 - Intermdiate Code Generation - Part 4, IR for type expressions
Lecture 33 - Intermdiate Code Generation - Part 4, IR for array expressions
Lecture 34 - Intermdiate Code Generation - Part 4, IR for boolean expressions
Lecture 35 - Intermdiate Code Generation - Part 4, IR for break, continue, switch
Lecture 36 - Code Generator - Part 1, Introduction, IR and target code
Lecture 37 - Code Generator - Part 2, Instruction selection, ordering
Lecture 38 - Code Generator - Part 2, Basic blocks and CFG
Lecture 39 - x86 assembly code
Lecture 40 - Code optimizer - Part 1, Local optimizations within a basic block
Lecture 41 - Code optimizer - Part 2, Array references, Peephole optimization
Lecture 42 - Discussions and doubts clarification - Part 4
Lecture 43 - Code optimizer - Part 3, Register allocation, Liveness
Lecture 44 - Code optimizer - Part 4, Register allocation as graph coloring
Lecture 45 - Discussions and doubts clarification - Part 5
Lecture 46 - Code optimizer - Part 5, Data flow analysis, Reaching definitions
Lecture 47 - Discussions and doubts clarification - Part 6
Lecture 48 - Code optimizer - Part 6, DFA for reaching definitions,Live variables
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NPTEL Video Course - Computer Science and Engineering - NOC:Applied Accelerated Artificial Intelligence

Subject Co-ordinator - Prof. Satyadhyan Chickerur, Prof. Bharatkumar Sharma, Prof. Adesuyi Tosin, Prof. Satya

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to AI Systems Hardware - Part 1
Lecture 2 - Introduction to AI Systems Hardware - Part 2
Lecture 3 - Introduction to AI Accelerators, GPUs
Lecture 4 - Introduction to Operating Systems, Virtualization, Cloud - Part 1
Lecture 5 - Introduction to Operating Systems, Virtualization, Cloud - Part 2
Lecture 6 - Introduction to Containers and IDE Dockers - Part 1
Lecture 7 - Introduction to Containers and IDE Dockers - Part 2
Lecture 8 - Scheduling and Resource Management - Part 1
Lecture 9 - Scheduling and Resource Management - Part 2
Lecture 10 - DeepOps: Deep Dive into Kubernetes with deployment of various AI based Services - Part 1
Lecture 11 - DeepOps: Deep Dive into Kubernetes with deployment of various AI based Services - Part 2
Lecture 12 - DeepOps: Deep Dive into Kubernetes with deployment of various AI based Services Session II - Par
Lecture 13 - DeepOps: Deep Dive into Kubernetes with deployment of various AI based Services Session II - Par
Lecture 14 - Design principles for Building High Performance Clusters - Part 1
Lecture 15 - Design principles for Building High Performance Clusters - Part 2
Lecture 16 - Design principles for Building High Performance Clusters - Part 3
Lecture 17 - Design principles for Building High Performance Clusters - Part 4
Lecture 18 - Introduction to Pytorch - Part 1
Lecture 19 - Introduction to Pytorch - Part 2
Lecture 20 - Introduction to Pytorch - Part 3
Lecture 21 - Introduction to Pytorch - Part 4
Lecture 22 - Profiling with DLProf Pytorch Catalyst - Part 1
Lecture 23 - Profiling with DLProf Pytorch Catalyst - Part 2
Lecture 24 - Introduction to TensorFlow - Part 1
Lecture 25 - Introduction to TensorFlow - Part 2
Lecture 26 - Accelerated TensorFlow - Part 1
Lecture 27 - Accelerated TensorFlow - Part 2
Lecture 28 - Accelerated TensorFlow - XLA Approach - Part 1
Lecture 29 - Accelerated TensorFlow - XLA Approach - Part 2

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Lecture 30 - Optimizing Deep learning Training: Automatic Mixed Precision - Part 1
Lecture 31 - Optimizing Deep learning Training: Automatic Mixed Precision - Part 2
Lecture 32 - Optimizing Deep learning Training: Transfer Learning - Part 1
Lecture 33 - Optimizing Deep learning Training: Transfer Learning - Part 2
Lecture 34 - Fundamentals of Distributed AI Computing Session 1 - Part 1
Lecture 35 - Fundamentals of Distributed AI Computing Session 1 - Part 2
Lecture 36 - Fundamentals of Distributed AI Computing Session 2 - Part 1
Lecture 37 - Fundamentals of Distributed AI Computing Session 2 - Part 2
Lecture 38 - Distributed Deep Learning using Tensorflow and Horovod
Lecture 39 - Challenges with Distributed Deep Learning Training Convergence
Lecture 40 - Fundamentals of Accelerating Deployment - Part 1
Lecture 41 - Fundamentals of Accelerating Deployment - Part 2
Lecture 42 - Accelerating neural network inference in PyTorch and TensorFlow - Part 1
Lecture 43 - Accelerating neural network inference in PyTorch and TensorFlow - Part 2
Lecture 44 - Accelerated Data Analytics - Part 1
Lecture 45 - Accelerated Data Analytics - Part 2
Lecture 46 - Accelerated Data Analytics - Part 3
Lecture 47 - Accelerated Data Analytics - Part 4
Lecture 48 - Accelerated Machine Learning
Lecture 49 - Scale Out with DASK
Lecture 50 - Web visualizations to GPU accelerated crossfiltering - Part 1
Lecture 51 - Web visualizations to GPU accelerated crossfiltering - Part 2
Lecture 52 - Accelerated ETL Pipeline with SPARK - Part 1
Lecture 53 - Accelerated ETL Pipeline with SPARK - Part 2
Lecture 54 - Applied AI: Smart City (Intelligent Video Analytics) Session 1 - Part 1
Lecture 55 - Applied AI: Smart City (Intelligent Video Analytics) Session 1 - Part 2
Lecture 56 - Applied AI: Smart City (Intelligent Video Analytics) Session 2 Deepstream - Part 1
Lecture 57 - Applied AI: Smart City (Intelligent Video Analytics) Session 2 Deepstream - Part 2
Lecture 58 - Applied AI: Health care Session I - Part 1
Lecture 59 - Applied AI: Health care Session I - Part 2
Lecture 60 - Applied AI: Health care Session II - Part 1
Lecture 61 - Applied AI: Health care Session II - Part 2
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NPTEL Video Course - Computer Science and Engineering - NOC:Social Network Analysis

Subject Co-ordinator - Prof. Tanmoy Chakraborty

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Chapter 1 Lectuer 1
Lecture 2 - Chapter 1 Lectuer 2
Lecture 3 - Chapter 1 Lectuer 3
Lecture 4 - Tutorial 1: Introduction to Python/Colab
Lecture 5 - Tutorial 2: Introduction to NetworkX - Part I
Lecture 6 - Chapter 2 Lectuer 1
Lecture 7 - Chapter 2 Lectuer 2
Lecture 8 - Chapter 2 Lectuer 3
Lecture 9 - Chapter 2 Lectuer 4
Lecture 10 - Chapter 2 Lectuer 5
Lecture 11 - Chapter 2 Lectuer 6
Lecture 12 - Tutorial 3: Introduction to NetworkX - Part II
Lecture 13 - Chapter 3 Lectuer 1
Lecture 14 - Chapter 3 Lectuer 2
Lecture 15 - Chapter 3 Lectuer 3
Lecture 16 - Chapter 3 Lectuer 4
Lecture 17 - Chapter 3 Lectuer 5
Lecture 18 - Chapter 3 Lectuer 6
Lecture 19 - Chapter 3 Lectuer 7
Lecture 20 - Chapter 4 Lectuer 1
Lecture 21 - Chapter 4 Lectuer 2
Lecture 22 - Chapter 4 Lectuer 3
Lecture 23 - Chapter 4 Lectuer 4
Lecture 24 - Chapter 4 Lectuer 5
Lecture 25 - Chapter 4 Lectuer 6
Lecture 26 - Tutorial 4
Lecture 27 - Chapter 5 Lectuer 1
Lecture 28 - Chapter 5 Lectuer 2
Lecture 29 - Chapter 5 Lectuer 3

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Lecture 30 - Chapter 5 Lectuer 4
Lecture 31 - Chapter 5 Lectuer 5
Lecture 32 - Chapter 5 Lectuer 6
Lecture 33 - Chapter 5 Lectuer 7
Lecture 34 - Chapter 5 Lectuer 8
Lecture 35 - Chapter 5 Lectuer 9
Lecture 36 - Chapter 5 Lectuer 10
Lecture 37 - Chapter 6 Lectuer 1
Lecture 38 - Chapter 6 Lectuer 2
Lecture 39 - Chapter 6 Lectuer 3
Lecture 40 - Chapter 6 Lectuer 4
Lecture 41 - Chapter 6 Lectuer 5
Lecture 42 - Chapter 7 Lectuer 1
Lecture 43 - Chapter 7 Lectuer 2
Lecture 44 - Chapter 7 Lectuer 3
Lecture 45 - Chapter 7 Lectuer 4
Lecture 46 - Chapter 7 Lectuer 5
Lecture 47 - Chapter 7 Lectuer 6
Lecture 48 - Chapter 7 Lectuer 7
Lecture 49 - Chapter 7 Lectuer 8
Lecture 50 - chapter 8 Lectuer 1
Lecture 51 - chapter 8 Lectuer 2
Lecture 52 - Chapter 8 Lectuer 3
Lecture 53 - Chapter 8 Lectuer 4
Lecture 54 - Chapter 8 Lectuer 5
Lecture 55 - Chapter 8 Lectuer 6
Lecture 56 - Chapter 9 Lectuer 1
Lecture 57 - Chapter 9 Lectuer 2
Lecture 58 - Chapter 9 Lectuer 3
Lecture 59 - Chapter 9 Lectuer 4
Lecture 60 - Chapter 9 Lectuer 5
Lecture 61 - Chapter 9 Lectuer 6
Lecture 62 - Chapter 9 Lectuer 7
Lecture 63 - Chapter 9 Lectuer 8
Lecture 64 - Chapter 9 Lectuer 9
Lecture 65 - Chapter 9 Lectuer 10
Lecture 66 - Chapter 9 Lectuer 11
Lecture 67 - Tutorial 5
Lecture 68 - Chapter 10 Lectuer 1
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Lecture 69 - Chapter 10 Lectuer 2
Lecture 70 - Chapter 10 Lectuer 3
Lecture 71 - Chapter 10 Lectuer 4
Lecture 72 - Chapter 10 Lectuer 5
Lecture 73 - Conclusion - Panel discussion
Lecture 74 - Conclusion
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NPTEL Video Course - Computer Science and Engineering - NOC:Quantum Algorithms and Cryptography

Subject Co-ordinator - Prof. Shweta Agrawal

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Quantum Algorithms and Cryptography
Lecture 2 - Basics of Quantum Information - Part 1
Lecture 3 - Basics of Quantum Information - Part 2
Lecture 4 - Computation and No-Cloning - Part 1
Lecture 5 - Computation and No-Cloning - Part 2
Lecture 6 - Computation and No-Cloning - Part 3
Lecture 7 - Going beyond classical - Part 1
Lecture 8 - Going beyond classical - Part 2
Lecture 9 - Going beyond classical - Part 3
Lecture 10 - Going beyond classical- Deutsch and Deutsch-Jozsa - Part 1
Lecture 11 - Going beyond classical- Deutsch and Deutsch-Jozsa - Part 2
Lecture 12 - Simon's and Bernstein's Vazirani Algorithm - Part 1
Lecture 13 - Simon's and Bernstein's Vazirani Algorithm - Part 2
Lecture 14 - Introduction to Cryptography - Part 1
Lecture 15 - Introduction to Cryptography - Part 2
Lecture 16 - Introduction to Cryptography - Part 3
Lecture 17 - Building Cryptography - Part 1
Lecture 18 - Building Cryptography - Part 2
Lecture 19 - Building Cryptography - Part 3
Lecture 20 - Building Cryptography - Part 4
Lecture 21 - Building Cryptography - Part 5
Lecture 22 - Building Public Key Encryption - Part 1
Lecture 23 - Building Public Key Encryption - Part 2
Lecture 24 - RSA Encryption - Part 1
Lecture 25 - RSA Encryption - Part 2
Lecture 26 - Finishing RSA, Fourier Transform - Part 1
Lecture 27 - Finishing RSA, Fourier Transform - Part 2
Lecture 28 - Finishing RSA, Fourier Transform - Part 3
Lecture 29 - Grover's Algorithm - Part 1

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Lecture 30 - Grover's Algorithm - Part 2
Lecture 31 - Grover's Algorithm - Part 3
Lecture 32 - Simon's Algorithm over Z_n - Part 1
Lecture 33 - Simon's Algorithm over Z_n - Part 2
Lecture 34 - Simon's Algorithm over Z_n - Part 3
Lecture 35 - Simon's Algorithm over Z_n - Part 4
Lecture 36 - Simon's Algorithm over Z_n - Part 5
Lecture 37 - Simon's Algorithm over Z_n - Part 6
Lecture 38 - Shor's Algorithm - Part 1
Lecture 39 - Shor's Algorithm - Part 2
Lecture 40 - Hidden Subgroup Problem - Part 1
Lecture 41 - Hidden Subgroup Problem - Part 2
Lecture 42 - Introduction to Lattices - Part 1
Lecture 43 - Introduction to Lattices - Part 2
Lecture 44 - Public Key Encryption from LWE - Part 1
Lecture 45 - Public Key Encryption from LWE - Part 2
Lecture 46 - Public Key Encryption from LWE - Part 3
Lecture 47 - Fully Homomorphic Encryption - Part 1
Lecture 48 - Fully Homomorphic Encryption - Part 2
Lecture 49 - Fully Homomorphic Encryption - Part 3
Lecture 50 - Quantum Cryptography - Part 1
Lecture 51 - Quantum Cryptography - Part 2
Lecture 52 - Quantum Cryptography - Part 3
Lecture 53 - Quantum Cryptography - Part 4
Lecture 54 - Quantum Cryptography - Part 5
Lecture 55 - Quantum PKE and FHE - Part 1
Lecture 56 - Quantum PKE and FHE - Part 2
Lecture 57 - Quantum PKE and FHE - Part 3
Lecture 58 - Quantum PKE and FHE - Part 4
Lecture 59 - Quantum PKE and FHE - Part 5
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NPTEL Video Course - Computer Science and Engineering - NOC:Theory of Computation (2023)

Subject Co-ordinator - Prof. Subrahmanyam Kalyanasundaram

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - An Introduction to The Theory of Computation
Lecture 2 - Notations and Terminology in Theory of Computation
Lecture 3 - An Introduction to Finite Automata and Regular Languages - Part 1
Lecture 4 - An Introduction to Finite Automata and Regular Languages - Part 2
Lecture 5 - Significance of Regular Languages and Regular Operations
Lecture 6 - Closure Properties of Regular Languages Under Union, Concatenation and Kleene Star Operation - Pa
Lecture 7 - Closure Properties of Regular Languages Under Union, Concatenation and Kleene Star Operation - Pa
Lecture 8 - An Introduction to Non-Deterministic Finite Automata (NFA)
Lecture 9 - Formal Definitions and Examples of Non-Deterministic Finite Automata (NFA)
Lecture 10 - Equivalence of NFA and DFA
Lecture 11 - Closure of Regular Languages Under Regular Operations (Using NFA)
Lecture 12 - Regular Expressions - Part 1
Lecture 13 - Regular Expressions - Part 2
Lecture 14 - Proving Equivalence of Regular Expression and DFA Through a GNFA
Lecture 15 - Pumping Lemma for Regular Languages - Part 1
Lecture 16 - Pumping Lemma for Regular Languages - Part 2
Lecture 17 - Distinguishability of Strings and Myhill-Nerode Theorem
Lecture 18 - Proving the Myhill-Nerode Theorem
Lecture 19 - An Introduction to Context-Free Languages - Part 1
Lecture 20 - An Introduction to Context-Free Languages - Part 2
Lecture 21 - Chomsky Normal Form
Lecture 22 - CYK Algorithm - Part 1
Lecture 23 - CYK Algorithm - Part 2 (Example)
Lecture 24 - Closure Properties of Context Free Languages
Lecture 25 - An Introduction to Push Down Automata
Lecture 26 - Normalizations in PDA and Intersection of Regular Language and CFL
Lecture 27 - Equivalence of Context Free Grammars and Push Down Automata - Part 1
Lecture 28 - Equivalence of Context Free Grammars and Push Down Automata - Part 2
Lecture 29 - Equivalence of Context Free Grammars and Push Down Automata - Part 3

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Lecture 30 - Pumping Lemma for Context Free Languages
Lecture 31 - Examples of Pumping Lemma Usage for Context Free Languages
Lecture 32 - Formal Definition of a Turing Machine
Lecture 33 - Turing Recognizable and Decidable Languages and TM Examples
Lecture 34 - Multitape Turing Machine
Lecture 35 - Non-Deterministic Turing Machines
Lecture 36 - Equivalence of Deterministic and Nondeterministic TM
Lecture 37 - Church-Turing Thesis
Lecture 38 - Decidable Problems Concerning Regular Languages
Lecture 39 - Decidable Problems Concerning Context Free Languages
Lecture 40 - Countability of Sets
Lecture 41 - Proof of Existence of Undecidable Languages
Lecture 42 - Halting Problem
Lecture 43 - Co-Turing Recognizability
Lecture 44 - An Introduction to Mapping Reducibility
Lecture 45 - Examples of Proving Undecidability Using Reductions
Lecture 46 - Rice Theorem
Lecture 47 - Computation Histories
Lecture 48 - The Post Correspondence Problem
Lecture 49 - Checking Ambiguity in CFG is Undecidable
Lecture 50 - Time Complexity - Part 1
Lecture 51 - Time Complexity - Part 2
Lecture 52 - Non-Deterministic Polynomial Time - Part 1
Lecture 53 - Non-Deterministic Polynomial Time - Part 2
Lecture 54 - Verifiability and NP
Lecture 55 - Polynomial Time Reductions - Part 1
Lecture 56 - Polynomial Time Reductions - Part 2
Lecture 57 - NP-Completeness
Lecture 58 - Cook-Levin Theorem
Lecture 59 - Cook-Levin Theorem - Proof and Implications
Lecture 60 - CLIQUE and VERTEX-COVER is NP-Complete
Lecture 61 - HAM-PATH is NP-Complete
Lecture 62 - SUBSET-SUM is NP-Complete
Lecture 63 - Knapsack Problem
Lecture 64 - Integer Linear Program is NP-Complete
Lecture 65 - Space Complexity and its Complexity Classes
Lecture 66 - Logspace Reductions and NL-Completeness
Lecture 67 - Savitch's theorem
Lecture 68 - Results in Space Complexity
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Lecture 69 - Summary and Concluding Remarks

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NPTEL Video Course - Computer Science and Engineering - NOC:Advanced Computer Networks

Subject Co-ordinator - Prof. Neminath Hubballi, Prof. Sameer Kulkarni

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - An Introduction to High Performance Switching and Routing - Part 1
Lecture 2 - An Introduction to High Performance Switching and Routing - Part 2
Lecture 3 - IP Table Lookup - Part 1
Lecture 4 - IP Table Lookup - Part 2
Lecture 5 - IP Table Lookup: Trie Based Data Structures - Part 1
Lecture 6 - IP Table Lookup: Trie Based Data Structures - Part 2
Lecture 7 - IP Table Lookup: Optimized Trie based Data Structures - Part 1
Lecture 8 - IP Table Lookup: Optimized Trie based Data Structures - Part 2
Lecture 9 - Packet Classification - Part 1
Lecture 10 - Packet Classification - Part 2
Lecture 11 - Packet Classification - Part 3
Lecture 12 - Packet Classification Implementation - Part 1
Lecture 13 - Packet Classification Implementation - Part 2
Lecture 14 - Traffic Management - Part 1
Lecture 15 - Traffic Management - Part 2
Lecture 16 - Traffic Management - Part 3
Lecture 17 - Traffic Management - Part 4
Lecture 18 - Traffic Management - Part 5
Lecture 19 - Traffic Management - Part 6
Lecture 20 - Traffic Management - Part 7
Lecture 21 - Packet Switching Fabric Design - Part 1
Lecture 22 - Packet Switching Fabric Design - Part 2
Lecture 23 - Introduction to Network Softwarization
Lecture 24 - Internet Impasse and Nework Ossification
Lecture 25 - Network Ossification
Lecture 26 - Network Virtualization - Part 1
Lecture 27 - Network Virtualization - Part 2
Lecture 28 - Road to SDN
Lecture 29 - Active Networks

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Lecture 30 - Data and Control Plane Separation
Lecture 31 - Control Plane Abstractions
Lecture 32 - Software Defined Networking - I
Lecture 33 - Software Defined Networking - II
Lecture 34 - Software Defined Networking - III
Lecture 35 - OpenFlow
Lecture 36 - SND Prospects and Challenges
Lecture 37 - Introduction to Network Function Virtualization - I
Lecture 38 - Introduction to Network Function Virtualization - II
Lecture 39 - Network Function Virtualization - Concepts, Framework and Architecture - I
Lecture 40 - Network Function Virtualization - Concepts, Framework and Architecture - II
Lecture 41 - Network Function Virtualization - Road ahead and Key challenges
Lecture 42 - High Performance Network Packet Processing
Lecture 43 - Summary and Comparision of NFV and SDN
Lecture 44 - Programmable Networks - Data Plane Programmability - Overview I
Lecture 45 - Programmable Networks - Data Plane Programmability - Overview II
Lecture 46 - Reconfigurable Match Action Tables
Lecture 47 - P4 Programming
Lecture 48 - Data Center Networking - Introduction - Part 1
Lecture 49 - Data Center Networking - Introduction - Part 2
Lecture 50 - Data Center Networking - Characteristics and Challenges
Lecture 51 - Data Center Networking - Topologies and Architecture - Part 1
Lecture 52 - Data Center Networking - Topologies and Architecture - Part 2
Lecture 53 - Data Center Networking - Protocol Innovations - Part 1
Lecture 54 - Data Center Networking - Protocol Innovations - Part 2
Lecture 55 - Network Telemetry
Lecture 56 - Serverless Computing - Part 1
Lecture 57 - Serverless Computing - Part 2
Lecture 58 - SmartNICs and In-band Network Telemetry, Future of Network Softwarization, SDN 3.0
Lecture 59 - QUIC
Lecture 60 - Green and Sustainable Data Centers
Lecture 61 - Content Distribution in IP Networks - Part 1
Lecture 62 - Content Distribution in IP Networks - Part 2
Lecture 63 - Information Centric Networking - Part 1
Lecture 64 - Information Centric Networking - Part 2
Lecture 65 - Information Centric Networking - Part 3
Lecture 66 - Named Data Networking - Part 1
Lecture 67 - Named Data Networking - Part 2
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NPTEL Video Course - Computer Science and Engineering - NOC:Affective Computing

Subject Co-ordinator - Prof. Jainendra Shukla, Prof. Abhinav Dhal

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Fundamentals of Affective computing
Lecture 2 - Fundamentals of Affective computing Applications
Lecture 3 - Emotion Psychology
Lecture 4 - Emotion Theory
Lecture 5 - Brain and Asymmetry
Lecture 6 - Emotional Design
Lecture 7 - Affect Elicitation
Lecture 8 - Experimental Methodology
Lecture 9 - Tutorial
Lecture 10 - Introduction to Facial Expression Recognition
Lecture 11 - Facial Feature Extraction
Lecture 12 - Group Level Emotion
Lecture 13 - Applications of Facial Expression Recognition
Lecture 14 - Tutorial
Lecture 15 - Tutorial
Lecture 16
Lecture 17
Lecture 18
Lecture 19
Lecture 20 - Tutorial
Lecture 21 - Emotions in Physiological Signals
Lecture 22 - Tutorial
Lecture 23 - Emotions via Skin Conductance
Lecture 24 - Emotions Via EEG
Lecture 25 - Multimodal Affect Recognition
Lecture 26 - Multimodal Analysis
Lecture 27 - MM Tutorial
Lecture 28 - Tutorial
Lecture 29

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Lecture 30
Lecture 31
Lecture 32 - Emotionally Intelligent Machines - Part 1
Lecture 33 - Emotionally Intelligent Machines - Part 2
Lecture 34 - Case Study
Lecture 35
Lecture 36
Lecture 37 - Ethics in Affective Computing - 1
Lecture 38 - Ethics in Affective Computing - 2
Lecture 39 - Course Finale
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NPTEL Video Course - Computer Science and Engineering - NOC:Optimisation for Machine Learning: Theory and Imp

Subject Co-ordinator - Prof. Pravesh Biyani

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Basics of Linear Algebra: Linear Independence
Lecture 2 - Linear Algebra: Rank of a matrix
Lecture 3 - Linear Algebra - Subspaces of a matrix - 1
Lecture 4 - Linear Algebra - Subspaces of a matrix - 2
Lecture 5 - Linear Algebra - Null space
Lecture 6 - Linear Algebra - Eigen Vectors/Values of a matrix - 1
Lecture 7 - Linear Algebra - Eigen Vectors/Values of a matrix - 2
Lecture 8 - Programming Eigen Decomposition using Python
Lecture 9 - Singular Value Decomposition - 1
Lecture 10 - Singular Value Decomposition - 2
Lecture 11 - Principal Component Analysis - 1
Lecture 12 - Principal Component Analysis - 2
Lecture 13 - Principal Component Analysis - 3
Lecture 14 - Principal Component Analysis - Coding
Lecture 15 - Machine Learning - Overview
Lecture 16 - Optimisation Problems
Lecture 17 - Gradient of a Vector Valued Function - 1
Lecture 18 - Gradient of a Vector Valued Function - 2
Lecture 19 - Neural Netowrks - Overview
Lecture 20 - Neural Netowrks - Backpropagation
Lecture 21 - Optimisation - Introduction to optimisation problems
Lecture 22 - Optimisation - Relaxation and approximate convergence
Lecture 23 - Optimisation - First Order Optimality Condition
Lecture 24 - Optimisation - Second Order Optimality Condition
Lecture 25 - Proof of Second Order Optimality Condition, Gradient Methods
Lecture 26 - Gradient Descent - 2
Lecture 27 - Variants of Gradient Descent - 1
Lecture 28 - Variants of Gradient Descent - 2
Lecture 29 - Variants of Gradient Descent - 3

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Lecture 30 - Convex Sets
Lecture 31 - Convex Functions
Lecture 32 - Duality and Lagrangian - Part 1
Lecture 33 - Duality and Lagrangian - Part 2
Lecture 34 - Duality and Lagrangian - Part 3
Lecture 35 - Coding: Introduction to Pytorch
Lecture 36 - Guest Lectuer: Support Vector Machine
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NPTEL Video Course - Computer Science and Engineering - ACM India - RBCDSAI Summer School on DS-AI-ML

Subject Co-ordinator - Multi-Faculty

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to AI/ML/DS
Lecture 2 - Introduction to Probability; Introduction to machine learning - Part 1
Lecture 3 - Introduction to Probability; Introduction to machine learning - Part 2
Lecture 4 - Introduction to Probability; Introduction to machine learning - Part 3
Lecture 5 - Introduction to Probability; Introduction to machine learning - Part 4
Lecture 6 - Python for AI/ML/DS - Part 1
Lecture 7 - Python for AI/ML/DS - Part 2
Lecture 8 - Descriptive statistics and Inferential statistics - Part 1
Lecture 9 - Descriptive statistics and Inferential statistics - Part 2
Lecture 10 - Descriptive statistics and Inferential statistics - Part 3
Lecture 11 - Descriptive statistics and Inferential statistics - Part 4
Lecture 12 - Descriptive statistics and Inferential statistics - Part 5
Lecture 13 - Distribution, Data visualization, Plotting libraries - Part 1
Lecture 14 - Distribution, Data visualization, Plotting libraries - Part 2
Lecture 15 - Distribution, Data visualization, Plotting libraries - Part 3
Lecture 16 - Linear Algebra for Data science
Lecture 17 - Identification of linear relationship among attributes
Lecture 18 - Solving Linear Equations - 1
Lecture 19 - Solving Linear Equations - 2
Lecture 20 - Linear Algebra - Distance, Hyperplanes and Halfspaces, Eigenvalues, Eigenvectors - Part 1
Lecture 21 - Linear Algebra - Distance, Hyperplanes and Halfspaces, Eigenvalues, Eigenvectors - Part 2
Lecture 22 - Linear Algebra - Part 1
Lecture 23 - Linear Algebra - Part 2
Lecture 24 - Linear Algebra - Part 3
Lecture 25 - Regression Models, Models Selection and Evaluation - Part 1
Lecture 26 - Regression Models, Models Selection and Evaluation - Part 2
Lecture 27 - Regression Models, Models Selection and Evaluation - Part 3
Lecture 28 - Regression Models, Models Selection and Evaluation - Part 4
Lecture 29 - Regression - Part 1

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Lecture 30 - Regression - Part 2
Lecture 31 - Regression - Part 3
Lecture 32 - Classification Naive Bayes, Logistic Regression, K-NN - Part 1
Lecture 33 - Classification Naive Bayes, Logistic Regression, K-NN - Part 2
Lecture 34 - Classification Naive Bayes, Logistic Regression, K-NN - Part 3
Lecture 35 - Classification Naive Bayes, Logistic Regression, K-NN - Part 4
Lecture 36 - Classification - Part 1
Lecture 37 - Classification - Part 2
Lecture 38 - Classification - Part 3
Lecture 39 - Linear Models for Classification - Part 1
Lecture 40 - Linear Models for Classification - Part 2
Lecture 41 - Kernel Machines
Lecture 42 - Solving Langrange Dual in SVM
Lecture 43 - Classification and SVM - Part 1
Lecture 44 - Classification and SVM - Part 2
Lecture 45 - Tree - Based methods, Boosting bagging - Part 1
Lecture 46 - Tree - Based methods, Boosting bagging - Part 2
Lecture 47 - Tree - Based methods, Boosting bagging - Part 3
Lecture 48 - Tree - Based methods, Boosting bagging - Part 4
Lecture 49 - Tree-based approaches for regression and classification - Part 1
Lecture 50 - Tree-based approaches for regression and classification - Part 2
Lecture 51 - Supervised Learning Using K Nearest Neighbors - Part 1
Lecture 52 - Supervised Learning Using K Nearest Neighbors - Part 2
Lecture 53 - Supervised Learning Using K Nearest Neighbors - Part 3
Lecture 54 - Supervised Learning Using K Nearest Neighbors - Part 4
Lecture 55 - Clustering methods - Part 1
Lecture 56 - Clustering methods - Part 2
Lecture 57 - Induction to Neural Networks, Perceptrons, Multilayer Perceptrons, Feedforward Neural Networks -
Lecture 58 - Induction to Neural Networks, Perceptrons, Multilayer Perceptrons, Feedforward Neural Networks -
Lecture 59 - Induction to Neural Networks, Perceptrons, Multilayer Perceptrons, Feedforward Neural Networks -
Lecture 60 - Induction to Neural Networks, Perceptrons, Multilayer Perceptrons, Feedforward Neural Networks -
Lecture 61 - Neural Networks and Feedforward NN - Part 1
Lecture 62 - Neural Networks and Feedforward NN - Part 2
Lecture 63 - Neural Networks and Feedforward NN - Part 3
Lecture 64 - Backpropagation (Intuition)
Lecture 65 - Backpropagation: Computing Cradients w.r.t the Output Units
Lecture 66 - Learning Parameters: Gradient Descent
Lecture 67 - Contours
Lecture 68 - Nesterov Accelerated Gradient Descent
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Lecture 69 - Stochastic and Mini-Batch Gradient Descent
Lecture 70 - Tips for Adjusting learning Rate and Momentum
Lecture 71 - Line Search
Lecture 72 - The convolution operation
Lecture 73 - Convolutional Neural Networks
Lecture 74 - CNN and DL models - Part 1
Lecture 75 - CNN and DL models - Part 2
Lecture 76 - CNN and DL models - Part 3
Lecture 77 - CNN and DL models - Part 4
Lecture 78 - AI/ML/DS Industry Use Cases - Part 1
Lecture 79 - AI/ML/DS Industry Use Cases - Part 2
Lecture 80 - AI/ML - Case Studies in Industry - Part 1
Lecture 81 - AI/ML - Case Studies in Industry - Part 2
Lecture 82 - Q and A on career in research a woman faculty representative from PSGTech and RBCDSAI
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NPTEL Video Course - Computer Science and Engineering - NOC:Machine Learning (ML) in Hindi

Subject Co-ordinator - Prof. Anubha Gupta

Co-ordinating Institute - IIIT - Delhi

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to Machine Learning
Lecture 2 - Linear Algebra: Review (Vector Spaces)
Lecture 3 - Linear Algebra: Review (Matrices)
Lecture 4 - Probability Theory: Review (Basics of Probability)
Lecture 5 - Probability Theory: Review (Random Variables)
Lecture 6 - Linear Regression
Lecture 7 - Linear Regression
Lecture 8 - Tutorial: Linear Regression
Lecture 9 - Linear Regression
Lecture 10 - Linear Kernel Regression
Lecture 11 - k-Nearest Neighbour (k-NN) Regression
Lecture 12 - Tutorial: k-NN Regression
Lecture 13 - Tutorial: Kernel Regression
Lecture 14 - Logistic Regression: Classification Evaluation Metrics
Lecture 15 - Logistic Regression
Lecture 16 - Logistic Regression: Examples
Lecture 17 - Tutorial: Logistic Regression
Lecture 18 - Neural Networks
Lecture 19 - Neural Networks
Lecture 20 - Neural Networks: Examples
Lecture 21 - Tutorial: Neural Networks
Lecture 22 - Practical Machine Learning - Part 1
Lecture 23 - Practical Machine Learning - Part 2
Lecture 24 - Practical Machine Learning - Part 3
Lecture 25 - Practical Machine Learning - Part 4
Lecture 26 - Support Vector Machines (SVM)
Lecture 27 - Tutorial: Support Vector Machines (SVM)
Lecture 28 - Kernel Support Vector Machines (k-SVM)
Lecture 29 - NaÃ¯ve Bayes Classification

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Lecture 30 - Decision Trees - Part 1
Lecture 31 - Decision Trees - Part 2
Lecture 32 - Tutorial: Naive Bayes Classification
Lecture 33 - Tutorial: Decision Trees
Lecture 34 - k-NN Classifier
Lecture 35 - Ensemble Learning
Lecture 36 - Random Forests
Lecture 37 - Bagging (Bootstrap AGGregatING)
Lecture 38 - Tutorial: Random Forests
Lecture 39 - Tutorial: k-NN Classifier and Bootstrap AGGregatING (Bagging)
Lecture 40 - Boosting
Lecture 41 - Clustering
Lecture 42 - k-means Clustering
Lecture 43 - Tutorial: Boosting
Lecture 44 - Spectral Clustering
Lecture 45 - Mixture of Models (Gaussian Mixture Models-GMM)
Lecture 46 - Dimensionality Reduction: Principal Component Analysis (PCA) and kernel PCA
Lecture 47 - Tutorial: k-means and Spectral Clustering
Lecture 48 - Tutorial: Principal Component Analysis (PCA) and Gaussian Mixture Models (GMM)
Lecture 49 - Introduction to Deep Learning (DL)
Lecture 50 - Convolutional Neural Networks (CNN) - Part A
Lecture 51 - Convolutional Neural Networks (CNN) - Part B
Lecture 52 - Autoencoders
Lecture 53 - Applications of ML in Healthcare Problems - Part 1
Lecture 54 - Applications of ML in Healthcare Problems - Part 2
Lecture 55 - Tutorial: CNN and Autoencoder
```

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NPTEL Video Course - Computer Science and Engineering - NOC:Cyber Security and Privacy

Subject Co-ordinator - Prof. Saji K Mathew

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction - Part 1
Lecture 2 - Introduction - Part 2
Lecture 3 - Introduction - Part 3
Lecture 4 - Foundations - Part 1
Lecture 5 - Foundations - Part 2
Lecture 6 - Foundations - Part 3
Lecture 7 - Security management, GRC - Part 1
Lecture 8 - Security management, GRC - Part 2
Lecture 9 - Security management, GRC - Part 3
Lecture 10 - Contingency planning - Part 1
Lecture 11 - Contingency Planning - Part 2
Lecture 12 - Contingency Planning - Part 3
Lecture 13 - Cybersecurity policy - Part 1
Lecture 14 - Cybersecurity policy - Part 2
Lecture 15 - Cybersecurity policy - Part 3
Lecture 16 - Risk Management - Part 1
Lecture 17 - Risk Management - Part 2
Lecture 18 - Risk Management - Part 3
Lecture 19 - Cybersecurity: Industry perspective - Part 1
Lecture 20 - Cybersecurity: Industry perspective - Part 2
Lecture 21 - Cybersecurity: Industry perspective - Part 3
Lecture 22 - Cyber security technologies - Part 1
Lecture 23 - Cyber security technologies - Part 2
Lecture 24 - Cyber security technologies - Part 3
Lecture 25 - Foundations of privacy - Part 1
Lecture 26 - Foundations of privacy - Part 2
Lecture 27 - Foundations of privacy - Part 3
Lecture 28 - Privacy regulation - Part 1
Lecture 29 - Privacy regulation - Part 2

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Lecture 30 - Privacy regulation - Part 3
Lecture 31 - Privacy regulation in Europe - Part 1
Lecture 32 - Privacy regulation in Europe - Part 2
Lecture 33 - Privacy regulation in Europe - Part 3
Lecture 34 - Privacy: The Indian Way - Part 1
Lecture 35 - Privacy: The Indian Way - Part 2
Lecture 36 - Privacy: The Indian Way - Part 3
Lecture 37 - Information privacy: Economics and strategy - Part 1
Lecture 38 - Information privacy: Economics and strategy - Part 2
Lecture 39 - Information privacy: Economics and strategy - Part 3
Lecture 40 - Privacy: Strategy and safety - Part 1
Lecture 41 - Privacy: Strategy and safety - Part 2
Lecture 42 - Privacy: Strategy and safety - Part 3
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NPTEL Video Course - Computer Science and Engineering - NOC:Business Intelligence and Analytics

Subject Co-ordinator - Prof. Saji K Mathew

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to Business Intelligence and Analytics
Lecture 2 - Patterns in Data
Lecture 3 - Vocabulary of Business Analytics
Lecture 4 - Course Overview
Lecture 5 - Case: Bizocity Scoring at AT&T
Lecture 6 - Business Intelligence Architecture
Lecture 7 - Data Management
Lecture 8 - Online Transaction Processing
Lecture 9 - Introduction To SQL
Lecture 10 - Normalisation
Lecture 11 - Shopsense Case in MySQL Workbench
Lecture 12 - Online Analytical Processing
Lecture 13 - Descriptive Data Analytics
Lecture 14 - Churn Analysis
Lecture 15 - Customer Lifetime Value
Lecture 16 - NPV-CLV Spreadsheet Analysis
Lecture 17 - Analytics Process
Lecture 18 - Introduction to Statistical Learning and Data Pre-Processing
Lecture 19 - Data Mining Process
Lecture 20 - Overview of Data Mining Techniques
Lecture 21 - Analytics Process Case
Lecture 22 - Introduction to Classification
Lecture 23 - Scoring Models
Lecture 24 - Classifier Performance
Lecture 25 - Decision Trees
Lecture 26 - Attribute Selection
Lecture 27 - Growing a Decision Tree
Lecture 28 - Decision Tree Application - Part 1
Lecture 29 - Decision Tree Application - Part 2

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Lecture 30 - Classification Demo - 1
Lecture 31 - Classification Demo - 2
Lecture 32 - Cluster Analysis
Lecture 33 - Clustering Techniques - Part 1
Lecture 34 - Clustering Techniques - Part 2
Lecture 35 - K-Means Clustering
Lecture 36 - Implementation in Python: Clustering for segmentation and profiling
Lecture 37 - RFM Analysis
Lecture 38 - Trendhub Case on RFM
Lecture 39 - RFM and Clustering
Lecture 40 - Artificial Neural Network
Lecture 41 - ANN Training
Lecture 42 - ANN for Financial Time Series Modelling
Lecture 43 - Implementation in Python: ANN
Lecture 44 - Introduction Text Mining
Lecture 45 - Text Mining Process
Lecture 46 - Text mining Using R - The Case of a Movie Discussion Forum
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NPTEL Video Course - Computer Science and Engineering - NOC:Responsible and Safe AI Systems

Subject Co-ordinator - Prof. Ponnurangam Kumaraguru, Prof. Balaraman Ravindran, Prof. Arun Rajkumar

Co-ordinating Institute - IIITH and IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction
Lecture 2 - AI Capabilities - Part 1
Lecture 3 - AI Capabilities - Part 2
Lecture 4 - AI Risk - Part 1
Lecture 5 - AI Risk - Part 2
Lecture 6 - AI Risk - Part 3
Lecture 7 - AI Risk Part 4"Risks associated with AI, getting harmful outputs from AI, biases
Lecture 8 - Robustness - Part 1
Lecture 9 - Robustness - Part 2
Lecture 10 - Robustness Hands-On
Lecture 11 - RLHF
Lecture 12 - AI Alignment
Lecture 13 - Transformers - Part 1
Lecture 14 - Transformers - Part 2
Lecture 15 - Hugging face
Lecture 16 - Unlearning
Lecture 17 - Approximate unlearning
Lecture 18 - Evaluation of Unlearning and Graph Unlearning - Part 1
Lecture 19 - Evaluation of Unlearning and Graph Unlearning - Part 2
Lecture 20 - Representation Engineering - Hands on
Lecture 21 - Introduction to ML - Part 1
Lecture 22 - Introduction to ML - Part 2
Lecture 23 - Basics of Neural Networks and PyTorch - Part 1
Lecture 24 - Basics of Neural Networks and PyTorch - Part 2
Lecture 25 - PyTorch - Basic Workflow
Lecture 26 - PyTorch - Classification
Lecture 27 - Bias - I
Lecture 28 - Bias - II
Lecture 29 - Source of Bias

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Lecture 30 - Bias - Handson
Lecture 31 - Bias - III
Lecture 32 - Bias - IV
Lecture 33 - Bias in VLM's
Lecture 34 - Bias Handson - Part 1
Lecture 35 - Bias Handson - Part 2
Lecture 36 - Data Privacy
Lecture 37 - Differential Privacy
Lecture 38 - Approximate Differential Privacy
Lecture 39 - Exponential Mechanism
Lecture 40 - Fairness in Machine Learning
Lecture 41 - Interpretability - I
Lecture 42 - Interpretability - II
Lecture 43 - Interpretability Hands-on - Part 1
Lecture 44 - Interpretability Hands-on - Part 2
Lecture 45 - AI Policies, Regulations, AGI - Part 1
Lecture 46 - AI Policies, Regulations, AGI - Part 2
Lecture 47 - AI Policies, Regulations, AGI - Part 3
Lecture 48 - AI Policies, AGI with Prof. David Krueger - Part 1
Lecture 49 - AI Policies, AGI with Prof. David Krueger - Part 2
Lecture 50 - Finetuning and Jailbreaking: Hands-on
Lecture 51 - AI Governance
Lecture 52 - Research Overview: SaGE- Quantifying moral consistency in LLMs
Lecture 53 - Research Overview: Higher Order Structures for Graph Explanations
Lecture 54 - Research Overview: Representation Surgery
Lecture 55 - Summary - Part 1
Lecture 56 - Summary - Part 2
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NPTEL Video Course - Computer Science and Engineering - NOC:Human Computer Interaction (Hindi and English)

Subject Co-ordinator - Prof. Rajiv Ratn Shah

Co-ordinating Institute - IIIT - Delhi

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to Human-Computer Interaction (HCI) - Part 1
Lecture 2 - Introduction to Human-Computer Interaction (HCI) - Part 2
Lecture 3 - Good Design Vs Bad Design
Lecture 4 - HCI Project
Lecture 5 - Design - Part 1
Lecture 6 - Design - Part 2
Lecture 7 - Inclusivity, Accessibility and Design Principles
Lecture 8 - Canva
Lecture 9 - Interaction - Part 1
Lecture 10 - Interaction - Part 2
Lecture 11 - Interaction Design Process
Lecture 12 - Prototyping with Figma
Lecture 13 - User Perspective - Part 1
Lecture 14 - User Perspective - Part 2
Lecture 15 - User Perspective
Lecture 16 - Miro
Lecture 17 - Mental/conceptual model
Lecture 18 - Interface - Part 1
Lecture 19 - Interface - Part 2
Lecture 20 - Cognitive Aspects in Human-Computer Interaction
Lecture 21 - Introduction to Behance
Lecture 22 - Data Requirement, Gathering, and Analysis
Lecture 23 - Data Gathering and Analysis
Lecture 24 - Panel Discussion: Ethics, Techniques, and Analysis in Data Gathering
Lecture 25 - IRB Overview
Lecture 26 - Prototyping and Smart UI - Part 1
Lecture 27 - Prototyping and Smart UI - Part 2
Lecture 28 - Hands-on Prototyping Techniques
Lecture 29 - Prototyping for Human-Computer Interaction

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Lecture 30 - Evaluation
Lecture 31 - Evaluation Techniques
Lecture 32 - Illustrator
Lecture 33 - Iterative design and evaluation
Lecture 34 - IoT and HCI
Lecture 35 - IoT and HCI
Lecture 36 - HCI and AI
Lecture 37 - LLM and HCI Tutorial
Lecture 38 - AI-Powered Tools for Content Generation and Analysis: Kyron
Lecture 39 - AI-Powered Tools for Content Generation and Analysis: Firefly, Audino
Lecture 40 - Privacy, Security, and HCI
Lecture 41 - HCI and AI in Conversational Systems
Lecture 42 - Human Centered AI for Autism Diagnosis
Lecture 43 - Conversational AI: Human-Centric Interaction through HCI and NLP
Lecture 44 - WAYV: Braille Assistive Gloves
```

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NPTEL Video Course - Computer Science and Engineering - NOC:Large Applications Practicum

Subject Co-ordinator - Prof. Varun Dutt

Co-ordinating Institute - IIT - Mandi

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to Makefiles: Build Automation - 1
Lecture 2 - Introduction to Makefiles: Build Automation - 2
Lecture 3 - Introduction to GIT: Version Control Simplified
Lecture 4 - Master GIT Workflow: Track and Commit
Lecture 5 - Master GIT: Track and Undo Changes
Lecture 6 - Master GIT: Fetch, Push and Tagging
Lecture 7 - Master GIT: Aliases, Branching and Commits
Lecture 8 - Master GIT: Merging, Conflict Resolution and Branch Management
Lecture 9 - Introduction to Code Documentation with Natural Docs
Lecture 10 - Mastering Code Documentation: Classes, Scope and Formatting
Lecture 11 - Advanced Documentation: Linking, Extra Topics and Abbreviated Syntax
Lecture 12 - Introduction to Software Testing: Verification, Validation and Testing Methods
Lecture 13 - JUnit for Java: Writing and Running Unit Tests in Eclipse
Lecture 14 - Code Coverage Analysis with EclEmma in Eclipse
Lecture 15 - Lexical Analysis with Flex: Tokenizing Input for Parsing
Lecture 16 - Introduction to Parsing with Bison: Building a Simple Expression Parser
Lecture 17 - Flex and Bison Integration: Creating a Complete Expression Parser
Lecture 18 - Introduction to UML: Use Case and Class Diagrams
Lecture 19 - UML Class Diagrams: Associations, Aggregation and Composition
Lecture 20 - Sequence Diagrams and UML Tools in Software Design
Lecture 21 - UML Editing and Code Generation with Umbrello
Lecture 22 - Introduction to Software Reverse Engineering: Disassemblers and Debuggers
Lecture 23 - Reverse Engineering Java and .NET Applications: Decompilers in Action

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NPTEL Video Course - Computer Science and Engineering - NOC:Introduction to Cryptology

Subject Co-ordinator - Dr. Sugata Gangopadhyay

Co-ordinating Institute - IIT - Roorkee

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction Caeser cipher
Lecture 2 - Modular arithmetic, shift cipher
Lecture 3 - Affine Cipher, Vigenere Cipher
Lecture 4 - Prefect secrecy, Application of Shift Cipher
Lecture 5 - Problem Discussion on Affine cipher and Perfect Secrecy
Lecture 6 - Product Cipher, Block Cipher, Modes of Operation for Block Cipher
Lecture 7 - Substitution Permutation network, Fiestel Cipher
Lecture 8 - S-Box Theory
Lecture 9 - Cryptanalysis and its Variants, Linear Attack
Lecture 10 - Problem Discussion
Lecture 11 - Public Key Cryptology Introduction RSA Cryptosystem
Lecture 12 - Complexity analysis of Euclidian Algorithm and RSA Cryptosystem square and multiply algorithm
Lecture 13 - Primality testing
Lecture 14 - Efficien Computation of Jacobi Symbol Primality Testing
Lecture 15 - Problem Discussion on Jacobi Symbol Calculation and RSA Cryptosystem
Lecture 16 - Cryptographic hash function
Lecture 17 - Random Oracle model, Security of hash functions
Lecture 18 - Randomized Algorithm and its application on Preimage resistance and collision resistance
Lecture 19 - Iterated Hash Functions
Lecture 20 - Problem Discussionn

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NPTEL Video Course - Computer Science and Engineering - NOC:Data Analytics with Python

Subject Co-ordinator - Prof. A. Ramesh

Co-ordinating Institute - IIT - Roorkee

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to data analytics
Lecture 2 - Python Fundamentals - I
Lecture 3 - Python Fundamentals - II
Lecture 4 - Central Tendency and Dispersion - I
Lecture 5 - Central Tendency and Dispersion - II
Lecture 6 - Introduction to Probability - I
Lecture 7 - Introduction to Probability - II
Lecture 8 - Probability Distributions - I
Lecture 9 - Probability Distributions - II
Lecture 10 - Probability Distributions - III
Lecture 11 - Python Demo for Distributions
Lecture 12 - Sampling and Sampling Distribution
Lecture 13 - Distribution of Sample Means, population, and variance
Lecture 14 - Confidence interval estimation
Lecture 15 - Confidence interval estimation
Lecture 16 - Hypothesis Testing - I
Lecture 17 - Hypothesis Testing - II
Lecture 18 - Hypothesis Testing - III
Lecture 19 - Errors in Hypothesis Testing
Lecture 20 - Hypothesis Testing
Lecture 21 - Hypothesis Testing
Lecture 22 - Hypothesis Testing
Lecture 23 - ANOVA - I
Lecture 24 - ANOVA - II
Lecture 25 - Post Hoc Analysis (Tukeyâ s test)
Lecture 26 - Randomize block design (RBD)
Lecture 27 - Two Way ANOVA
Lecture 28 - Linear Regression - I
Lecture 29 - Linear Regression - II

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Lecture 30 - Linear Regression - III
Lecture 31 - Estimation, Prediction of Regression Model Residual Analysis - I
Lecture 32 - Estimation, Prediction of Regression Model Residual Analysis - II
Lecture 33 - Multiple Regression Model - I
Lecture 34 - Multiple Regression Model - II
Lecture 35 - Categorical variable regression
Lecture 36 - Maximum Likelihood Estimation - I
Lecture 37 - Maximum Likelihood Estimation - II
Lecture 38 - Logistic Regression - I
Lecture 39 - Logistic Regression - II
Lecture 40 - Linear Regression Model Vs Logistic Regression Model
Lecture 41 - Confusion matrix and ROC - I
Lecture 42 - Confusion Matrix and ROC - II
Lecture 43 - Performance of Logistic Model - III
Lecture 44 - Regression Analysis Model Building - I
Lecture 45 - Regression Analysis Model Building (Interaction) - II
Lecture 46 - Chi - Square Test of Independence - I
Lecture 47 - Chi-Square Test of Independence - II
Lecture 48 - Chi-Square Goodness of Fit Test
Lecture 49 - Cluster analysis
Lecture 50 - Clustering analysis - Part II
Lecture 51 - Clustering analysis - Part III
Lecture 52 - Cluster analysis - Part IV
Lecture 53 - Cluster analysis - Part V
Lecture 54 - K- Means Clustering
Lecture 55 - Hierarchical method of clustering - I
Lecture 56 - Hierarchical method of clustering - II
Lecture 57 - Classification and Regression Trees (CART) - I
Lecture 58 - Measures of attribute selection
Lecture 59 - Attribute selection Measures in (CART) - II
Lecture 60 - Classification and Regression Trees (CART) - III
```

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NPTEL Video Course - Computer Science and Engineering - NOC:Fundamentals of Object Oriented Programming

Subject Co-ordinator - Prof. Balasubramanian Raman

Co-ordinating Institute - IIT - Roorkee

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to Object-Oriented Programming
Lecture 2 - Introduction to Classes and Objects in C++
Lecture 3 - Introduction to Member Data and Member Functions in C++
Lecture 4 - Introduction to Classes and Objects in Java
Lecture 5 - Introduction to Paradigms of OOP
Lecture 6 - Classes and Objects in C++
Lecture 7 - Classes and Objects in Java and Solved problems
Lecture 8 - Constructors in C++ - Default and Parameterized
Lecture 9 - Constructors in C++ - Copy Constructor
Lecture 10 - Constructors in Java - Default and Parameterized
Lecture 11 - Access Specifiers in C++
Lecture 12 - Inheritance - Single Inheritance
Lecture 13 - Inheritance - Multilevel Inheritance
Lecture 14 - Inheritance - Multiple, Hierarchial, and Hybrid
Lecture 15 - Inheritance and Introduction to Friend Function
Lecture 16 - Polymorphism
Lecture 17 - Overloading - Operator and Constructor
Lecture 18 - this keyword in C++
Lecture 19 - Method Overloading
Lecture 20 - Method Overriding
Lecture 21 - Encapsulation - I
Lecture 22 - Encapsulation - II
Lecture 23 - Data Abstraction
Lecture 24 - Virtual Functions in C++ and Abstract Class
Lecture 25 - Interface in Java
Lecture 26 - Exception Handling in C++
Lecture 27 - Exception Handling - Solved Problems
Lecture 28 - Multiple Catch and Nested try Statements
Lecture 29 - 'throws' keyword in Java

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Lecture 30 - 'finally' keyword in Java
Lecture 31 - Basics of File Handling
Lecture 32 - File Handling - Solved Problems
Lecture 33 - File Handling - Append and other Mathematical Operations
Lecture 34 - File Handling - Character, Line, and CSV File Reading
Lecture 35 - Serialization and Deserialization
Lecture 36 - Introduction to Templates and Generics
Lecture 37 - Template Class in C++
Lecture 38 - Generics in Java
Lecture 39 - Generics in Java (Continued...)
Lecture 40 - Generics in Python
Lecture 41 - Introduction to Standard Template Library
Lecture 42 - Associative Containers
Lecture 43 - Unordered Containers, Iterators
Lecture 44 - STL Algorithms
Lecture 45 - Case Studies - Library Management System, Real-Time Stock Tracker
Lecture 46 - Design Patterns
Lecture 47 - Singleton and Factory Pattern
Lecture 48 - Factory Pattern in Java
Lecture 49 - Observer Pattern
Lecture 50 - Structural Patterns
Lecture 51 - Advanced Topics - Multithreading and Concurrency
Lecture 52 - Deadlocks - Causes and Prevention
Lecture 53 - Introduction to Network Programming
Lecture 54 - Communication over HTTP and Related Protocols
Lecture 55 - GUI Development
Lecture 56 - Case Study - Mathematical Computation Framework C++
Lecture 57 - Case Study - Hotel reservation System C++
Lecture 58 - Case Study - Online Shopping Cart Java
Lecture 59 - Case Study - Employee Payroll System Java
Lecture 60 - Case Study - Image Classification Tool Python
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NPTEL Video Course - Computer Science and Engineering - Combinatorics

Subject Co-ordinator - Dr. L. Sunil Chandran

Co-ordinating Institute - IISc - Bangalore

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Pigeon hole principle - (Part 1)
Lecture 2 - Pigeon hole principle - (Part 2)
Lecture 3 - Pigeon hole principle - (Part 3)
Lecture 4 - Pigeon hole principle - (Part 4)
Lecture 5 - Elementary concepts and basic counting principles
Lecture 6 - Elementary concepts; Binomial theorem; Bijective proofs - Part (1)
Lecture 7 - Bijective proofs â   Part (2)
Lecture 8 - Bijective proofs - Part (3); Properties of binomial coefficients; Combinatorial identities - Part
Lecture 9 - Combinatorial identities - Part (2); Permutations of multisets â   Part (1)
Lecture 10 - Permutations of multisets â   Part (2)
Lecture 11 - Multinomial Theorem, Combinations of Multisets â   Part (1)
Lecture 12 - Combinations of Multisets - Part (2)
Lecture 13 - Combinations of Multisets â   Part (3), Bounds for binomial coefficients
Lecture 14 - Sterlingâ s Formula, Generalization of Binomial coefficients - Part (1)
Lecture 15 - Generalization of Binomial coefficients - Part (2)
Lecture 16 - Generalization of Binomial coefficients - Part (3); Double counting - Part (1)
Lecture 17 - Double counting - Part (2)
Lecture 18 - Hallâ s Theorem for regular bipartite graphs; Inclusion exclusion principle - Part (1)
Lecture 19 - Inclusion exclusion principle - Part (2)
Lecture 20 - Inclusion exclusion principle - Part (3)
Lecture 21 - Inclusion exclusion principle - Part (4)
Lecture 22 - Inclusion exclusion principle - Part (5)
Lecture 23 - Recurrence Relations - Part (1)
Lecture 24 - Recurrence Relations - Part (2)
Lecture 25 - Recurrence Relations - Part (3)
Lecture 26 - Recurrence Relations - Part (4)
Lecture 27 - Recurrence Relations - Part (5)
Lecture 28 - Generating functions - Part (1)
Lecture 29 - Generating functions - Part (2)

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Lecture 30 - Solving recurrence relations using generating functions - Part (1)
Lecture 31 - Solving recurrence relations using generating functions - Part (2)
Lecture 32 - Exponential generating functions - Part (1)
Lecture 33 - Exponential generating functions - Part (2), Partition Number - Part (1)
Lecture 34 - Partition Number - Part (2)
Lecture 35 - Partition Number - Part (3)
Lecture 36 - Partition Number - Part (4); Catalan Numbers - Part (1)
Lecture 37 - Catalans Numbers - Part (2)
Lecture 38 - Catalan Numbers - Part (3), Sterling numbers of the 2nd kind
Lecture 39 - Difference Sequences
Lecture 40 - Sterling Numbers
Lecture 41 - Summary
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NPTEL Video Course - Computer Science and Engineering - Compiler Design (Prof. Y.N. Srikanth)

Subject Co-ordinator - Prof. Y.N. Srikanth

Co-ordinating Institute - IISc - Bangalore

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable


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Lecture 1 - An Overview of a Compiler - Part 1
Lecture 2 - An Overview of a Compiler - Part 2 and Run-Time Environments - Part 1
Lecture 3 - An Overview of a Compiler - Part 2 and Run-Time Environments - Part 1
Lecture 4 - Run-Time Environments - Part 2
Lecture 5 - Run-Time Environments - Part 3 and Local Optimizations - Part 1
Lecture 6 - Run-Time Environments - Part 3 and Local Optimizations - Part 1
Lecture 7 - Local Optimizations - Part 2 and Code Generation - Part 1
Lecture 8 - Local Optimizations - Part 2 and Code Generation - Part 1
Lecture 9 - Code Generation - Part 1
Lecture 10 - Code Generation - Part 2
Lecture 11 - Code Generation - Part 3 and Global Register Allocation - Part 1
Lecture 12 - Code Generation - Part 3 and Global Register Allocation - Part 1
Lecture 13 - Global Register Allocation - Part 2
Lecture 14 - Global Register Allocation - Part 3 and Implementing Object-Oriented Languages - Part 1
Lecture 15 - Global Register Allocation - Part 3 and Implementing Object-Oriented Languages - Part 1
Lecture 16 - Implementing Object-Oriented Languages - Part 2 and Introduction to Machine-Independent Optimiza
Lecture 17 - Implementing Object-Oriented Languages - Part 2 and Introduction to Machine-Independent Optimiza
Lecture 18 - Introduction to Machine-Independent Optimizations - Part 2 and Data-Flow Analysis - Part 1
Lecture 19 - Introduction to Machine-Independent Optimizations - Part 2 and Data-Flow Analysis - Part 1
Lecture 20 - Data-Flow Analysis - Part 2
Lecture 21 - Data-Flow Analysis - Part 3 and Control-Flow Analysis - Part 1
Lecture 22 - Data-Flow Analysis - Part 3 and Control-Flow Analysis - Part 1
Lecture 23 - Control-Flow Analysis - Part 2
Lecture 24 - Machine-Independent Optimizations - Part 1
Lecture 25 - Machine-Independent Optimizations - Part 2
Lecture 26 - Machine-Independent Optimizations - Part 3 and Data-Flow Analysis
Lecture 27 - Machine-Independent Optimizations - Part 3 and Data-Flow Analysis
Lecture 28 - Data-Flow Analysis
Lecture 29 - Data-Flow Analysis
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Lecture 30 - Partial Redundancy Elimination - Part 2
Lecture 31 - The Static Single Assignment Form
Lecture 32 - The Static Single Assignment Form
Lecture 33 - The Static Single Assignment Form
Lecture 34 - Automatic Parallelization - Part 1
Lecture 35 - Automatic Parallelization - Part 2
Lecture 36 - Automatic Parallelization - Part 3
Lecture 37 - Automatic Parallelization - Part 4
Lecture 38 - Instruction Scheduling - Part 1
Lecture 39 - Instruction Scheduling - Part 2
Lecture 40 - Instruction Scheduling - Part 3
Lecture 41 - Software Pipelining
Lecture 42 - Energy-Aware Software Systems - Part 1
Lecture 43 - Energy-Aware Software Systems - Part 2
Lecture 44 - Energy-Aware Software Systems - Part 3
Lecture 45 - Energy-Aware Software Systems - Part 4
Lecture 46 - Just-In-Time Compilation and Optimizations for .NET CLR
Lecture 47 - Garbage Collection
Lecture 48 - Interprocedural Data-Flow Analysis
Lecture 49 - Worst Case Execution Time - Part 1
Lecture 50 - Worst Case Execution Time - Part 2
```

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NPTEL Video Course - Computer Science and Engineering - Graph Theory

Subject Co-ordinator - Dr. L. Sunil Chandran

Co-ordinating Institute - IISc - Bangalore

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction
Lecture 2 - Matchings
Lecture 3 - More on Hallâ s theorem and some applications
Lecture 4 - Tutteâ s theorem on existence of a perfect matching
Lecture 5 - More on Tutteâ s theorem
Lecture 6 - More on Matchings
Lecture 7 - Dominating set, path cover
Lecture 8 - Gallai â Millgram theorem, Dilworthâ s theorem
Lecture 9 - Connectivity
Lecture 10 - Mengerâ s theorem
Lecture 11 - More on connectivity
Lecture 12 - Minors, topological minors and more on k- linkedness
Lecture 13 - Vertex coloring
Lecture 14 - More on vertex coloring
Lecture 15 - Edge coloring
Lecture 16 - Proof of Vizingâ s theorem, Introduction to planarity
Lecture 17 - 5- coloring planar graphs, Kuratowskyâ s theorem
Lecture 18 - Proof of Kuratowskyâ s theorem, List coloring
Lecture 19 - List chromatic index
Lecture 20 - Adjacency polynomial of a graph and combinatorial Nullstellensatz
Lecture 21 - Chromatic polynomial, k - critical graphs
Lecture 22 - Gallai-Roy theorem, Acyclic coloring, Hadwigerâ s conjecture
Lecture 23 - Perfect graphs
Lecture 24 - Interval graphs, chordal graphs
Lecture 25 - Proof of weak perfect graph theorem (WPGT)
Lecture 26 - Second proof of WPGT, Some non-perfect graph classes
Lecture 27 - More special classes of graphs
Lecture 28 - Boxicity,Sphericity, Hamiltonian circuits
Lecture 29 - More on Hamiltonicity

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Lecture 30 - Chvatalâ s theorem, toughness, Hamiltonicity and 4-color conjecture
Lecture 31 - Network flows
Lecture 32 - More on network flows
Lecture 33 - Circulations and tensions
Lecture 34 - More on circulations and tensions, flow number and Tutteâ s flow conjectures
Lecture 35 - Random graphs and probabilistic method
Lecture 36 - Probabilistic method
Lecture 37 - Probabilistic method
Lecture 38 - Probabilistic method
Lecture 39 - Graph minors and Hadwigerâ s conjecture
Lecture 40 - More on graph minors, tree decompositions
```

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NPTEL Video Course - Computer Science and Engineering - High Performance Computing

Subject Co-ordinator - Prof. Mathew Jacob

Co-ordinating Institute - IISc - Bangalore

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Programs and Data
Lecture 2 - Data Representation
Lecture 3 - Registers and Memory
Lecture 4 - Instructions, Addressing Modes
Lecture 5 - A RISC Instruction Set
Lecture 6 - A RISC Instruction Set (Continued...)
Lecture 7 - Function Call and Return
Lecture 8 - Function Call and Return (Continued...)
Lecture 9 - Instruction Execution
Lecture 10 - Instruction Execution (Continued...)
Lecture 11 - Software organization
Lecture 12 - System Calls
Lecture 13 - Virtual memory
Lecture 14 - Virtual memory (Continued...)
Lecture 15 - Virtual Memory (Continued...)
Lecture 16 - Process
Lecture 17 - Process scheduling
Lecture 18 - Process lifetime
Lecture 19 - Interprocess communication
Lecture 20 - Concurrent programming
Lecture 21 - Pipelining
Lecture 22 - Pipeline hazards
Lecture 23 - Pipeline hazards (Continued...)
Lecture 24 - Pipeline hazards (Continued...)
Lecture 25 - Cache memory
Lecture 26 - Memory hierarchy
Lecture 27 - Cache operation
Lecture 28 - Cache operation (Continued)
Lecture 29 - Cache aware programming

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Lecture 30 - Cache aware programming (Continued...)
Lecture 31 - More on cache
Lecture 32 - Measuring time
Lecture 33 - Program Profiling
Lecture 34 - Secondary storage
Lecture 35 - Files and disks
Lecture 36 - Directories
Lecture 37 - Protection and Performance
Lecture 38 - Parallel architecture
Lecture 39 - Cache coherence
Lecture 40 - MPI programming
Lecture 41 - MPI programming (Continued...)
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NPTEL Video Course - Computer Science and Engineering - Numerical Optimization

Subject Co-ordinator - Dr. Shirish K. Shevade

Co-ordinating Institute - IISc - Bangalore

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction
Lecture 2 - Mathematical Background
Lecture 3 - Mathematical Background (Continued...)
Lecture 4 - One Dimensional Optimization - Optimality Conditions
Lecture 5 - One Dimensional Optimization (Continued...)
Lecture 6 - Convex Sets
Lecture 7 - Convex Sets (Continued...)
Lecture 8 - Convex Functions
Lecture 9 - Convex Functions (Continued...)
Lecture 10 - Multi Dimensional Optimization - Optimality Conditions, Conceptual Algorithm
Lecture 11 - Line Search Techniques
Lecture 12 - Global Convergence Theorem
Lecture 13 - Steepest Descent Method
Lecture 14 - Classical Newton Method
Lecture 15 - Trust Region and Quasi-Newton Methods
Lecture 16 - Quasi-Newton Methods - Rank One Correction, DFP Method
Lecture 17 - i) Quasi-Newton Methods - Broyden Family ii) Coordinate Descent Method
Lecture 18 - Conjugate Directions
Lecture 19 - Conjugate Gradient Method
Lecture 20 - Constrained Optimization - Local and Global Solutions, Conceptual Algorithm
Lecture 21 - Feasible and Descent Directions
Lecture 22 - First Order KKT Conditions
Lecture 23 - Constraint Qualifications
Lecture 24 - Convex Programming Problem
Lecture 25 - Second Order KKT Conditions
Lecture 26 - Second Order KKT Conditions (Continued...)
Lecture 27 - Weak and Strong Duality
Lecture 28 - Geometric Interpretation
Lecture 29 - Lagrangian Saddle Point and Wolfe Dual

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Lecture 30 - Linear Programming Problem
Lecture 31 - Geometric Solution
Lecture 32 - Basic Feasible Solution
Lecture 33 - Optimality Conditions and Simplex Tableau
Lecture 34 - Simplex Algorithm and Two-Phase Method
Lecture 35 - Duality in Linear Programming
Lecture 36 - Interior Point Methods - Affine Scaling Method
Lecture 37 - Karmarkar's Method
Lecture 38 - Lagrange Methods, Active Set Method
Lecture 39 - Active Set Method (Continued...)
Lecture 40 - Barrier and Penalty Methods, Augmented Lagrangian Method and Cutting Plane Method
Lecture 41 - Summary
```

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NPTEL Video Course - Computer Science and Engineering - Storage Systems

Subject Co-ordinator - Dr. K. Gopinath

Co-ordinating Institute - IISc - Bangalore

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Overview
Lecture 2 - Storage, Processing, Networking
Lecture 3 - Naming and Storing
Lecture 4 - Storage Filesystems
Lecture 5 - Access Architecture, Hard Disks
Lecture 6 - SCSI
Lecture 7 - Fibre Channel Protocol (FCP)
Lecture 8 - FCP, 10Gb Ethernet, iSCSI, TCP
Lecture 9 - NFS, NFSv2
Lecture 10 - NFSv2, NFSv3, NFSv4, CIFS
Lecture 11 - USB Storage
Lecture 12 - Tiering
Lecture 13 - Mobile/Personal/Organizational - type Storage
Lecture 14 - Parallel/Cloud/Web-scale Storage
Lecture 15 - Long-term Storage
Lecture 16 - Storage interfaces
Lecture 17 - User-Memory-CPU interactions
Lecture 18 - Spinlock, Concurrency
Lecture 19 - Block Layer design
Lecture 20 - FAT, TFAT, F2FS, LFS, FTL
Lecture 21 - Data Structures
Lecture 22 - Abstractions
Lecture 23 - Link & Write Operations
Lecture 24 - ZFS
Lecture 25 - RAID in Filesystems
Lecture 26 - RAID-Z, NetApp RAID4, Flash Filesystems
Lecture 27 - Reliability
Lecture 28 - Performance
Lecture 29 - Security

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Lecture 30 - CAP Theorem
Lecture 31 - POSIX/NFS/S3/Zookeeper, ACID Vs. BASE
Lecture 32 - Consistency & Commit problems
Lecture 33 - Paxos
Lecture 34 - Group Communication problem
Lecture 35 - Message Ordering
Lecture 36 - Ordering Models
Lecture 37 - Orderings in Filesystems
Lecture 38 - Semantics of highly scalable filesystems
Lecture 39 - GFS
Lecture 40 - GFS Model
Lecture 41 - GFS functions and operations
Lecture 42 - GFS problems, BigTable
Lecture 43 - Lessons to learn
```

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NPTEL Video Course - Computer Science and Engineering - System Analysis and Design

Subject Co-ordinator - Prof. V. Rajaraman

Co-ordinating Institute - IISc - Bangalore

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture - 1
Lecture - 2
Lecture - 3
Lecture - 4
Lecture - 5
Lecture - 6
Lecture - 7
Lecture - 8
Lecture - 9
Lecture - 10
Lecture - 11
Lecture - 12
Lecture - 13
Lecture - 14
Lecture - 15
Lecture - 16
Lecture - 17
Lecture - 18
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Lecture - 21
Lecture - 22
Lecture - 23
Lecture - 24
Lecture - 25
Lecture - 26
Lecture - 27
Lecture - 28
Lecture - 29

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Lecture - 30
Lecture - 31
Lecture - 32
Lecture - 33
Lecture - 34
Lecture - 35
Lecture - 36
Lecture - 37
Lecture - 38
Lecture - 39
Lecture - 40
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NPTEL Video Course - Computer Science and Engineering - Principles of Compiler Design

Subject Co-ordinator - Prof. Y.N. Srikanth

Co-ordinating Institute - IISc - Bangalore

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - An Overview of a Compiler
Lecture 2 - Lexical Analysis - Part 1
Lecture 3 - Lexical Analysis - Part 2
Lecture 4 - Lexical Analysis - Part 3
Lecture 5 - Syntax Analysis
Lecture 6 - Syntax Analysis
Lecture 7 - Syntax Analysis
Lecture 8 - Syntax Analysis
Lecture 9 - Syntax Analysis
Lecture 10 - Syntax Analysis
Lecture 11 - Syntax Analysis
Lecture 12 - Semantic Analysis with Attribute Grammars Part - 1
Lecture 13 - Semantic Analysis with Attribute Grammars Part - 2
Lecture 14 - Semantic Analysis with Attribute Grammars Part - 3
Lecture 15 - Semantic Analysis with Attribute Grammars Part - 4
Lecture 16 - Semantic Analysis with Attribute Grammars Part - 5
Lecture 17 - Intermediate code generation Part - 1
Lecture 18 - Intermediate code generation Part - 2
Lecture 19 - Intermediate code generation Part - 3
Lecture 20 - Intermediate code generation Part - 4 (first half of lecture)
Lecture 21 - Run-time environments - 1 (second half of lecture)
Lecture 22 - Run-time environments - 2
Lecture 23 - Run-time environments - 3
Lecture 24 - Run-time environments - 4 (first half of lecture)
Lecture 25 - Control-Flow Graph and Local Optimizations - Part 1 (second half of lecture)
Lecture 26 - Control-Flow Graph and Local Optimizations - Part 2 (first half of lecture)
Lecture 27 - Machine code generation - 1 (second half of lecture)
Lecture 28 - Machine code generation - 2
Lecture 29 - Machine code generation - 3

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Lecture 30 - Machine code generation - 4 (first half of lecture), Implementing object-oriented languages 1 (s
Lecture 31 - Implementing object-oriented languages 2 (first half of lecture)
Lecture 32 - Global register allocation - 1 (second half of lecture)
Lecture 33 - Global register allocation - 2
Lecture 34 - Global register allocation - 3
Lecture 35 - Introduction to Machine-Independent Optimizations - 1
Lecture 36 - Introduction to Machine-Independent Optimizations - 2
Lecture 37 - Introduction to Machine-Independent Optimizations - 3
Lecture 38 - Introduction to Machine-Independent Optimizations - 4
Lecture 39 - Introduction to Machine-Independent Optimizations - 5
Lecture 40 - Introduction to Machine-Independent Optimizations - 6
Lecture 41 - Introduction to Machine-Independent Optimizations - 7 (first half of lecture)
Lecture 42 - Instruction Scheduling and Software Pipelining - 1 (second half of lecture)
Lecture 43 - Instruction Scheduling and Software Pipelining - 2
Lecture 44 - Instruction Scheduling and Software Pipelining - 3 (first part of lecture)
Lecture 45 - Automatic parallelization - 1 (second half of lecture)
Lecture 46 - Automatic parallelization - 2
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NPTEL Video Course - Computer Science and Engineering - NOC:Discrete Mathematics (IIITB)

Subject Co-ordinator - Prof. Ashish Choudhury

Co-ordinating Institute - IIIT - Bangalore

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to Mathematical Logic
Lecture 2 - Logical Equivalence
Lecture 3 - SAT Problem
Lecture 4 - Rules of Inference
Lecture 5 - Resolution
Lecture 6 - Tutorial 1 - Part I
Lecture 7 - Tutorial 1 - Part II
Lecture 8 - Predicate Logic
Lecture 9 - Rules of Inferences in Predicate Logic
Lecture 10 - Proof Strategies - I
Lecture 11 - Proof Strategies - II
Lecture 12 - Induction
Lecture 13 - Tutorial 2 - Part I
Lecture 14 - Tutorial 2 - Part II
Lecture 15 - Sets
Lecture 16 - Relations
Lecture 17 - Operations on Relations
Lecture 18 - Transitive Closure of Relations
Lecture 19 - Warshallâ s Algorithm for Computing Transitive Closure
Lecture 20 - Tutorial - 3
Lecture 21 - Equivalence Relation
Lecture 22 - Equivalence Relations and Partitions
Lecture 23 - Partial Ordering
Lecture 24 - Functions
Lecture 25 - Tutorial 4 - Part I
Lecture 26 - Tutorial 4 - Part II
Lecture 27 - Countable and Uncountable Sets
Lecture 28 - Examples of Countably Infinite Sets
Lecture 29 - Cantorâ s Diagonalization Argument

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Lecture 30 - Uncomputable Functions
Lecture 31 - Tutorial - 5
Lecture 32 - Basic Rules of Counting
Lecture 33 - Permutation and Combination
Lecture 34 - Counting Using Recurrence Equations
Lecture 35 - Solving Linear Homogeneous Recurrence Equations - Part I
Lecture 36 - Solving Linear Homogeneous Recurrence Equations - Part II
Lecture 37 - Tutorial 6 - Part I
Lecture 38 - Tutorial 6 - Part II
Lecture 39 - Solving Linear Non-Homogeneous Recurrence Equations
Lecture 40 - Catalan Numbers
Lecture 41 - Catalan Numbers - Derivation of Closed Form Formula
Lecture 42 - Counting Using Principle of Inclusion-Exclusion
Lecture 43 - Tutorial - 7
Lecture 44 - Graph Theory Basics
Lecture 45 - Matching
Lecture 46 - Proof of Hallâ s Marriage Theorem
Lecture 47 - Various Operations on Graphs
Lecture 48 - Vertex and Edge Connectivity
Lecture 49 - Tutorial - 8
Lecture 50 - Euler Path and Euler Circuit
Lecture 51 - Hamiltonian Circuit
Lecture 52 - Vertex and Edge Coloring
Lecture 53 - Tutorial 9 - Part I
Lecture 54 - Tutorial 9 - Part II
Lecture 55 - Modular Arithmetic
Lecture 56 - Prime Numbers and GCD
Lecture 57 - Properties of GCD and Bézoutâ s Theorem
Lecture 58 - Linear Congruence Equations and Chinese Remainder Theorem
Lecture 59 - Uniqueness Proof of the CRT
Lecture 60 - Fermatâ s Little Theorem, Primality Testing and Carmichael Numbers
Lecture 61 - Group Theory
Lecture 62 - Cyclic Groups
Lecture 63 - Subgroups
Lecture 64 - Discrete Logarithm and Cryptographic Applications
Lecture 65 - More Applications of Groups
Lecture 66 - Rings, Fields and Polynomials
Lecture 67 - Polynomials Over Fields and Properties
Lecture 68 - Finite Fields and Properties - I

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Lecture 69 - Finite Fields and Properties - II
Lecture 70 - Primitive Element of a Finite Field
Lecture 71 - Applications of Finite Fields
Lecture 72 - Goodbye and Farewell

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NPTEL Video Course - Computer Science and Engineering - NOC:Secure Computation: Part I

Subject Co-ordinator - Prof. Ashish Choudhury

Co-ordinating Institute - IIITB

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - What is Secure MPC
Lecture 2 - Real-World Examples of Secure MPC
Lecture 3 - Various Dimensions to Study Secure MPC
Lecture 4 - Recap of Basic Concepts from Abstract Algebra
Lecture 5 - Recap of Basic Concepts from Abstract Algebra (Continued...)
Lecture 6 - Recap of Basic Concepts from Cryptography
Lecture 7 - Secret sharing
Lecture 8 - Additive Secret Sharing
Lecture 9 - Inefficient Threshold Secret Sharing
Lecture 10 - Polynomials Over Fields
Lecture 11 - Shamir Secret-Sharing
Lecture 12 - Linear secret-sharing
Lecture 13 - Linear Secret Sharing (Continued...)
Lecture 14 - General Secret Sharing
Lecture 15 - Perfectly-Secure Message Transmission
Lecture 16 - A Toy MPC Protocol
Lecture 17 - A Toy MPC Protocol (Continued...)
Lecture 18 - A Toy MPC Protocol (Continued...)
Lecture 19 - The BGW MPC Protocol
Lecture 20 - The BGW MPC Protocol for Linear Functions
Lecture 21 - The BGW MPC Protocol for Linear Functions: Security Analysis
Lecture 22 - The BGW MPC Protocol: The Case of Non-Linear Gates
Lecture 23 - The Degree-Reduction Problem
Lecture 24 - The Gennaro-Rabin-Rabin (GRR) Degree-Reduction Method
Lecture 25 - Analysis of the GRR, Degree-Reduction Method
Lecture 26 - Shared Circuit-Evaluation via GRR Degree-Reduction Method
Lecture 27 - Shared Circuit-Evaluation in the Pre-processing Model
Lecture 28 - Optimality of Corruption Bound for Perfectly-Secure MPC
Lecture 29 - Perfectly-Secure MPC Tolerating General (Non-Threshold) Adversaries

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Lecture 30 - Perfectly-Secure MPC Tolerating General (Non-Threshold) Adversaries with Q^((2)) Condition
Lecture 31 - Perfectly-Secure MPC for Small Number of Parties
Lecture 32 - Perfectly-Secure 3PC (Continued...)
Lecture 33 - More Efficient Perfectly-Secure 3PC
Lecture 34 - More Efficient Perfectly-Secure 3PC (Continued...)
Lecture 35 - Towards Cryptographically-Secure MPC
Lecture 36 - GMW MPC protocol
Lecture 37 - Oblivious Transfer (OT)
Lecture 38 - RSA Assumption and RSA Hard-Core Predicate
Lecture 39 - Bit OT Based on RSA Assumption and Hard-Core Predicate
Lecture 40 - Discrete Logarithm and DDH Assumption
Lecture 41 - OT Based on the DDH Assumption
Lecture 42 - Pre-Processing Phase for the GMW Protocol
Lecture 43 - Pre-Processing Phase for the GMW Protocol: The n-Party Case
Lecture 44 - Pre-Processing Phase for the GMW Protocol (Continued...)
Lecture 45 - Pre-Processing of OT
Lecture 46 - OT Extension
Lecture 47 - Analysis of IKNP OT Extension
Lecture 48 - Yaoâ s Protocol for Secure 2PC
Lecture 49 - Yaoâ s Garbling Scheme
Lecture 50 - Yaoâ s Protocol for Secure 2PC
Lecture 51 - Optimizations for Yaoâ s Garbling
Lecture 52 - Interpreting Yaoâ s Secure 2PC Protocol as a Secret-Sharing Based Protocol
Lecture 53 - Mixed Protocols for Secure 2PC
Lecture 54 - The Arithmetic, Boolean and Yao Sharing for Secure 2PC
Lecture 55 - The ABY Conversions
Lecture 56 - The ABY Conversions (Continued...)
Lecture 57 - The ABY Conversions (Continued...)
Lecture 58 - ABY Computations : Example
Lecture 59 - Goodbye and Farewell
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NPTEL Video Course - Computer Science and Engineering - NOC:Secure Computation - Part II

Subject Co-ordinator - Prof. Ashish Choudhury

Co-ordinating Institute - IISc - Bangalore

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - What is Secure Multi-Party Computation (MPC)?
Lecture 2 - Reliable Broadcast and Byzantine Agreement
Lecture 3 - EIG Protocol for Perfectly-Secure Byzantine Agreement
Lecture 4 - EIG Protocol for Perfectly-Secure Byzantine Agreement: Illustration
Lecture 5 - EIG Protocol for Perfectly-Secure Byzantine Agreement: Analysis - Part I
Lecture 6 - EIG Protocol for Perfectly-Secure Byzantine Agreement: Analysis - Part II
Lecture 7 - Efficient Protocols for Perfectly-Secure Byzantine Agreement - Part I
Lecture 8 - Efficient Protocols for Perfectly-Secure Byzantine Agreement - Part II
Lecture 9 - Domain Extension for Perfectly-Secure Byzantine Agreement
Lecture 10 - Cryptographically/Statistically-Secure Reliable Broadcast
Lecture 11 - Dolev-Strong Reliable Broadcast Protocol: Analysis
Lecture 12 - Randomized Protocol for Byzantine Agreement - Part I
Lecture 13 - Randomized Protocol for Byzantine Agreement - Part II
Lecture 14 - Randomized Protocol for Byzantine Agreement - Part III
Lecture 15 - Lower Bound for Number of Parties for Byzantine Agreement - Part I
Lecture 16 - Lower Bound for Number of Parties for Byzantine Agreement - Part II
Lecture 17 - Lower Bound for Number of Parties for Byzantine Agreement - Part III
Lecture 18 - Recap of Basic Concepts from Abstract Algebra
Lecture 19 - Reed-Solomon Error-Correcting Codes
Lecture 20 - Perfectly-Secure Message Transmission
Lecture 21 - Properties of Polynomials Over a Field - I
Lecture 22 - Properties of Polynomials Over a Field - II
Lecture 23 - One Round PSMT Protocol
Lecture 24 - Multi-Round PSMT Protocol - I
Lecture 25 - Multi-Round PSMT Protocol - II
Lecture 26 - Domain Extension for Perfectly-Secure Broadcast Based on RS Error-Correcting Codes - I
Lecture 27 - Domain Extension for Perfectly-Secure Broadcast Based on RS Error-Correcting Codes - II
Lecture 28 - Domain Extension for Perfectly-Secure Broadcast Based on RS Error-Correcting Codes - III
Lecture 29 - (n,t) - Star Structure

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Lecture 30 - Domain Extension for Perfectly-Secure Broadcast Based on RS Error-Correcting Codes - IV
Lecture 31 - The BGW MPC Protocol for Passive Corruptions: Recap
Lecture 32 - The BGW MPC Protocol for Byzantine Corruptions: Challenges
Lecture 33 - Perfectly-Secure VSS: Necessary Condition
Lecture 34 - Bivariate Polynomials Over Finite Fields - I
Lecture 35 - Bivariate Polynomials Over Finite Fields - II
Lecture 36 - Bivariate Polynomials Over Finite Fields - III
Lecture 37 - Bivariate Polynomials Over Finite Fields - IV
Lecture 38 - Perfectly-Secure VSS with n greater than 3t - Part I
Lecture 39 - Perfectly-Secure VSS with n greater than 3t - Part II
Lecture 40 - Perfectly-Secure VSS with n greater than 3t - Part III
Lecture 41 - Perfectly-Secure VSS with n greater than 3t - A Round-Reducing Technique
Lecture 42 - Perfectly-Secure VSS with n greater than 4t - Part I
Lecture 43 - Perfectly-Secure VSS with n greater than 4t - Part II
Lecture 44 - The BGW MPC Protocol for Linear Functions
Lecture 45 - The BGW MPC Protocol for Linear Functions: Security Analysis
Lecture 46 - The BGW MPC Protocol: The Case of Non-Linear Gates
Lecture 47 - The Degree-Reduction Problem
Lecture 48 - Generating Random Multiplication-Triples - I
Lecture 49 - Generating Random Multiplication-Triples - II
Lecture 50 - Generating Random Multiplication-Triples - III
Lecture 51 - Perfectly-Secure Protocol for Verifying Multiplicative Relationship
Lecture 52 - Perfectly-Secure Verifiable Triple-Sharing Protocol
Lecture 53 - Perfectly-Secure Triple-Extraction Protocol
Lecture 54 - Towards Secure MPC with an Honest Majority
Lecture 55 - ICP from Information-Theoretic MAC - I
Lecture 56 - ICP from Information-Theoretic MAC - II
Lecture 57 - Ingredients for Statistically-Secure MPC
Lecture 58 - Statistically-Secure VSS
Lecture 59 - Cyclic Groups and Discrete Logarithm
Lecture 60 - Pedersen Commitment Scheme
Lecture 61 - Cryptographically-secure VSS and MPC
Lecture 62 - Goodbye and Farewell

NPTEL Video Course - Computer Science and Engineering - NOC:Introduction to Graph Algorithms

Subject Co-ordinator - Prof. C. Pandu Rangan

Co-ordinating Institute - IISc - Bangalore

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction and Principles of Algorithms - Part 1
Lecture 2 - Principles of Algorithms - Part 2
Lecture 3 - Shortest Path Algorithms
Lecture 4 - Undirected Graph
Lecture 5 - Algorithms for finding Shortest Path - Part 1
Lecture 6 - Algorithms for finding Shortest Path - Part 2
Lecture 7 - Single source shortest path problem
Lecture 8 - Properties of shortest path distances - Part 1
Lecture 9 - Properties of shortest path distances - Part 2
Lecture 10 - Belman Equation - Part 1
Lecture 11 - Belman Equation - Part 2
Lecture 12 - Belman Equation - Part 3
Lecture 13 - Belman Equation - Part 4
Lecture 14 - Bellman Ford - Part 1
Lecture 15 - Bellman Ford - Part 2
Lecture 16 - Dijkstra Algorithm - Part 1
Lecture 17 - Dijkstra Algorithm - Part 2
Lecture 18 - Dijkstra Algorithm - Part 3
Lecture 19 - All Pair Shortest - Path 1
Lecture 20 - All Pair Shortest - Path 2
Lecture 21 - All Pair Shortest - Path 3 and 4
Lecture 22 - All Pair Shortest - Path 5
Lecture 23 - Prims Algorithm - Part 1
Lecture 24 - Prims Algorithm - Part 2
Lecture 25 - Kruskal's Algorithm - Part 1
Lecture 26 - Kruskal's Algorithm - Part 2
Lecture 27 - Kruskal's Algorithm - Part 3
Lecture 28 - DFS
Lecture 29 - DFS

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Lecture 30 - Algorithm for Cut Vertex
Lecture 31 - Iterative DFS
Lecture 32 - DFS in Directed Graph
Lecture 33 - Strong Connected Components - Part 1
Lecture 34 - Strong Connected Components - Part 2
Lecture 35 - Strong Connected Components - Part 3
Lecture 36 - Strong Connected Components - Part 4
Lecture 37 - BFS
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NPTEL Video Course - Computer Science and Engineering - NOC:Linear Algebra Through Geometry

Subject Co-ordinator - Prof. Ashok Rao, Prof. M Krishna Kumar, Prof. Arulalan M R

Co-ordinating Institute - IISc - Bangalore

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to Linear Algebra and Matrices
Lecture 2 - Geometry of System of linear equations - Straight lines andplanes, Matrix Definitions
Lecture 3 - Some Interpretations to solutions of system of linear equations
Lecture 4 - Matrix Operations, Homogeneous system of equations
Lecture 5 - Matrix Operations, Homogeneous system of equations
Lecture 6 - Elementary Row Operations
Lecture 7 - Elementary Row operations - How do they work?
Lecture 8 - Determinant and Inverse of a matrix
Lecture 9 - Interpreting the inverse of a matrix
Lecture 10 - Cramer's rule
Lecture 11 - Points and Vectors in 2D
Lecture 12 - Vector Length and properties
Lecture 13 - Combining Vectors
Lecture 14 - Linearly Independent and Dependent vectors, Dot Product of vectors
Lecture 15 - Angle between two vectors, Orthogonal projections
Lecture 16 - Lines and Parametric Equations of lines, Linear Maps
Lecture 17 - Rotation, Shear and Projection transformations
Lecture 18 - Determinant of 2x2 matrix as Area of Parallelogram,Determinant of linear transformations
Lecture 19 - System of 2 linear equations in 2 unknowns from vector perspective
Lecture 20 - Eigenvalues and eigenvectors
Lecture 21 - Vectors in 3D, Linear combination of vectors in 3D
Lecture 22 - Projectionvector on another vector, line passing through origin, plane passing through origin
Lecture 23 - Area of a parallelogram in 3D, Cross product
Lecture 24 - Interpreting the cross-product, Properties of cross-product
Lecture 25 - Volume of a parallelepiped, Lines in 3D, Intersection of line and plane
Lecture 26 - Linear Maps in 3D - Scaling and Reflection
Lecture 27 - Linear Maps in 3D - Reflection about a plane, Shear
Lecture 28 - Rotation in 3D
Lecture 29 - Determinant and its properties

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Lecture 30 - eigenvalues and eigenvectors in 3D
Lecture 31 - Linear systems in 3D and geometric perspective
Lecture 32 - Homogeneous system in 3D
Lecture 33 - LU Decomposition
Lecture 34 - Least Squares Solution, Gram-Schmidt Orthogonalization, QRDecomposition
Lecture 35 - Orthogonal Matrix, Linear Independence, eigenvalues and eigenvectors in 3D
Lecture 36 - Vector Space and Properties
Lecture 37 - Examples of vector spaces - Polynomial space, planes and lines through origin
Lecture 38 - Vector Subspaces and their geometry
Lecture 39 - Combining vectors in a vector space, Linear Independence
Lecture 40 - Span, Basis, Dimension of a vector space, Fourier Expansion
Lecture 41 - Homogeneous system of linear equations and null space of a matrix
Lecture 42 - Column Space of A
Lecture 43 - Subspaces associated matrix A transpose, Nullity, Rank
Lecture 44 - Orthogonal Complement of a subspace
Lecture 45 - Orientation of the four fundamental subspaces of a matrix A
Lecture 46 - System of linear equations with no solution - Inconsistent systems
Lecture 47 - Least squares solution, Pseudoinverse of A
Lecture 48 - Projection and Projection Matrices
Lecture 49 - Pseudoinverse of special matrices
Lecture 50 - Eigendecomposition
Lecture 51 - Eigensubspace and dimension
Lecture 52 - Real Symmetric matrix and properties
Lecture 53 - Eigenvalues and eigenvectors of real symmetric matrices
Lecture 54 - Effect of a real symmetric matrix - Geometric Interpretation
Lecture 55 - Spectral Theorem, Quadratic Forms
Lecture 56 - Singular Value Decomposition
Lecture 57 - Relationship between SVD and Eigen Decomposition
Lecture 58 - An Interpretation of SVD
Lecture 59 - Fourier Series and Transform through Linear Algebra
Lecture 60 - Practical Applications of Linear Algebra - 1
Lecture 61 - Practical Applications of Linear Algebra - 2
Lecture 62 - Summary and Credits
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NPTEL Video Course - Computer Science and Engineering - NOC:Algorithms in Computational Biology and Sequence

Subject Co-ordinator - Prof. Chirag Jain

Co-ordinating Institute - IISc - Bangalore

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Course overview
Lecture 2 - Molecular biology and high-throughput sequencing
Lecture 3 - Data structures/Algorithms Warmup
Lecture 4 - Bitvector rank operations
Lecture 5 - Demo for constructing rank data structure
Lecture 6 - Z-algorithm
Lecture 7 - Suffix Arrays
Lecture 8 - Suffix array construction using prefix doubling
Lecture 9 - Demo for constructing suffix array
Lecture 10 - Suffix Tree
Lecture 11 - Building Suffix Trees
Lecture 12 - Building Suffix Trees (Continued...)
Lecture 13 - Applications of suffix trees
Lecture 14 - Burrows Wheeler Indexes
Lecture 15 - Burrows Wheeler Indexes (Continued...)
Lecture 16 - How is BWT useful for indexing genomes ?
Lecture 17 - Sequence Alignment and Edit Distance
Lecture 18 - Global and semi-global alignment
Lecture 19 - Local alignment
Lecture 20 - Scoring gaps in alignments
Lecture 21 - Alignment significance statitstics
Lecture 22 - Alignment demonstration
Lecture 23 - Heuristics for genome-scale alignment
Lecture 24 - Maximal unique matches
Lecture 25 - Co-linear chaining
Lecture 26 - Incorporating gaps into the chaining algorithm
Lecture 27 - IGV Demonstration
Lecture 28 - Genome assembly
Lecture 29 - Shortest common superstring

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Lecture 30 - Greedy algorithm for genome assembly
Lecture 31 - Genome assembly using de Bruijn graphs
Lecture 32 - Multiplex de Bruijn graphs and Overlap graphs
Lecture 33 - Assembly Demonstration
Lecture 34 - Introduction to phylogeny trees
Lecture 35 - Distance based tree reconstruction
Lecture 36 - Character based tree reconstruction
Lecture 37 - Phylogenetic trees Demo
Lecture 38 - Hidden Markov Models
Lecture 39 - Hidden Markov Models (Continued...)
Lecture 40 - ProtGPT2 Demo
Lecture 41 - Pangenome Graphs
Lecture 42 - Pangenome Demo
Lecture 43 - Multiple Sequence Alignment
Lecture 44 - Multiple Sequence Alignment Demo
Lecture 45 - Sequence alignment to pangenome graphs
Lecture 46 - Genomic Large Language Models
Lecture 47 - Course Summary
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