

Lecture 1 - Introduction

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Lecture 28 - PCA; SVD; Towards Latent Semantic Indexing (LSI)

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DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : Design and Analysis of Algorithms (Computer Science and Engineering)

Co-ordinators : Prof. Sundar Viswanathan, Prof. Ajit A Diwan, Prof. Abhiram G Ranade

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DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : Software Engineering (Computer Science and Engineering)

Co-ordinators : Prof. N.L. Sarda, Prof. Umesh Bellur, Prof. Rushikesh K Joshi

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- 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
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- Lecture 23 - Case Study
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- Lecture 26 - Agile Development
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- Lecture 30 - Project Scope Management
- Lecture 31 - Project Time Management

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Lecture 8 - Elementary Graph Algorithms - Part 2

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Lecture 11 - Data Flow Graphs

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Lecture 14 - Testing Source Code: Classical Coverage Criteria

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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: Graph Coverage Criteria

Lecture 21 - Logic: Basics Needed for Software Testing

Lecture 22 - Logic: Coverage Criteria

Lecture 23 - Coverage Criteria, (Continued...)

Lecture 24 - Logic Coverage Criteria

Lecture 25 - Logic Coverage Criteria: Applied to Test Code_1

Lecture 26 - Logic Coverage Criteria: Applied to Test Code_2

Lecture 27 - Logic Coverage Criteria: Issues in Applying to Test Code

Lecture 28 - Logic Coverage Criteria: Applied to Test Specifications

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DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : NOC:Design and Pedagogy of the Introductory Programming Course (Computer Science and Engineering)

Co-ordinators : Prof. Abhiram G Ranade

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Lecture 3 - Introduction and Survey.1: Experience with the standard approach

Lecture 4 - Introduction and Survey.2: Alternative approaches, Summary, and Conclusion

Lecture 5 - Basic Ideas in Our Approach.0: Introduction

Lecture 6 - Basic Ideas in Our Approach.1: Examples of translating manual algorithms to computer programs

Lecture 7 - Basic Ideas in Our Approach.2: More examples

Lecture 8 - Basic Ideas in Our Approach.3: Should we teach students (manual) problem solving strategies?

Lecture 9 - Basic Ideas in Our Approach.4: The design of the course

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Lecture 12 - Pedagogy.0: Introduction and basic principles

Lecture 13 - Pedagogy.1: Scaffolding, Lesson Plan

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Lecture 17 - Advanced Programming Topics.0: Introduction, Organization of medium sized programs

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Lecture 20 - In class questions, Assignments, Examinations.0: In class questions and lab assignments

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DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : NOC:An Introduction to Programming through C++ (Computer Science and Engineering)

Co-ordinators : Prof. Abhiram G Ranade

Lecture 1 - Introduction - Part 1

Lecture 2 - Introduction - Part 2

Lecture 3 - Introduction - Part 3

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Lecture 18 - Conditional Execution - Part 1

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Lecture 20 - More general form of conditions - Part 3

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Lecture 22 - Switch statement and logical data - Part 5

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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 : Taylor series

Lecture 30 - Computing Mathematical Functions - Part 2 : Numerical integration

Lecture 31 - Computing Mathematical Functions - Part 3 : Bisection Method

- Lecture 32 - Computing Mathematical Functions - Part 4 : Newton Raphson Method
- Lecture 33 - Loops in various applications - Part 1 : Loops in various applications brute force algorithms
- Lecture 34 - Loops in various applications - Part 2 : Finding Pythagorean Triples
- Lecture 35 - Loops in various applications - Part 3 : Modelling a system: bargaining
- Lecture 36 - Loops in various applications - Part 4 : Simulating a water tank
- Lecture 37 - Loops in various applications - Part 5 : Arithmetic on very large numbers
- Lecture 38 - Functions - Part 1 : Basics
- Lecture 39 - Functions - Part 2 : Examples
- Lecture 40 - Functions - Part 3 : Reference parameters
- Lecture 41 - Functions - Part 4 : Pointers
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- Lecture 44 - Recursion - Part 2 : Recursive objects, Tree drawing
- Lecture 45 - Recursion - Part 3 : How to think about recursion
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- Lecture 47 - Virahanka Numbers - Part 2 : Recursive Program
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- Lecture 49 - Program Organization and Functions - Part 1 : Introduction
- Lecture 50 - Program Organization and Functions - Part 2 : Splitting into files
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- Lecture 53 - Advanced Features of Functions - Part 1 : Introduction and passing one function to another
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- Lecture 57 - Array Part-1 - Part 1 : Introduction
- Lecture 58 - Array Part-1 - Part 2 : Marks averaging problem
- Lecture 59 - Array Part-1 - Part 3 : Histogram computation
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- Lecture 61 - Array Part-1 - Part 5 : Polynomial multiplication
- Lecture 62 - Array Part-1 - Part 6 : Queues in dispatching taxis
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Lecture 24 - Address Translation

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Lecture 26 - Creating a network with Sub-net mask

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DIGIMAT - The No.1 Learning Management Platform for Creative Learning

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Co-ordinators : Prof. Varsha Apte

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Co-ordinators : Prof.Arnab sarkar, Prof.Jatindra Kumar Deka, Dr. Santosh Biswas

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DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : NOC:Embedded Systems-Design Verification and Test (Computer Science and Engineering)

Co-ordinators : Prof.Jatindra Kumar Deka, Dr. Santosh Biswas, Prof.Arnab Sarkar

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NPTEL : NOC:Design and Implementation of Human-Computer Interfaces (Computer Science and Engineering)

Co-ordinators : Prof. Samit Bhattacharya

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[Lecture 55 - Pre and post increment](#)

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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

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Lecture 10 - SQL: Advanced Queries

Lecture 11 - SQL: Updates, Joins, Views and Triggers

Lecture 12 - Normalization Theory: Motivation

Lecture 13 - Normalization Theory: 1 NF and 2NF

Lecture 14 - Normalization Theory: 3NF

Lecture 15 - Normalization Theory: BCNF

Lecture 16 - Normalization Theory: MVD

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Lecture 19 - Database Indexing: Tree-based Indexing

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- [Lecture 33 - Schedules: Introduction](#)
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- [Lecture 38 - Concurrency Control: Locks](#)
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Lecture 7 - Equivalence of NFA and DFA, Closure properties

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Lecture 9 - Algebraic properties, RE to NFA conversion

Lecture 10 - GNFA to RE conversion

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Lecture 15 - Introduction to CFGs

Lecture 16 - Examples of CFGs, Reg subset of CFL

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Lecture 20 - Examples of non- CFLs

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Lecture 22 - Pushdown Automata - Definition and Example

Lecture 23 - Pushdown Automata - Examples and Relation with CFGs

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[Lecture 40 - More on NP-Completeness](#)

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Lecture 2 - Groups : Subgroups and homomorphism

Lecture 3 - Groups : Isomorphism

Lecture 4 - Groups : Quotienting

Lecture 5 - Groups : Structure Theorem

Lecture 6 - Groups : Applications

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Lecture 8 - Rings : Failure of Unique Factorization

Lecture 9 - Rings : Birth of Ideals

Lecture 10 - Rings : Ideal Arithmetic

Lecture 11 - Rings : Special Ideals

Lecture 12 - Rings : Dedekind Domains

Lecture 13 - Rings : Quotient 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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Lecture 2 - Paths, Cycles and Trails

Lecture 3 - Eulerian Circuits, Vertex Degrees and Counting

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Lecture 6 - Spanning Trees and Enumeration

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Lecture 8 - Independent Sets, Covers and Maximum Bipartite Matching

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Lecture 13 - Connectivity and Paths: Cuts and Connectivity

Lecture 14 - k-Connected Graphs

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Lecture 16 - Vertex Coloring and Upper Bounds

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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

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

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Lecture 17 - Design of HBase

Lecture 18 - Peer to Peer Systems in Cloud Computing

Lecture 19 - MapReduce

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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

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Lecture 11 - Spark Built-in Libraries

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Lecture 14 - CAP Theorem

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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

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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

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Lecture 31 - PageRank Algorithm in Big Data

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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

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 - Savitch's Theorem

Lecture 8 - Immerman-Szelepcsenyi 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 - Shannon's Theorem and Karp-Lipton-Sipser Theorem

Lecture 16 - Bounded Depth Circuit Classes

Lecture 17 - Kannan'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 - Toda's Theorem - I

Lecture 27 - Toda's Theorem - II

Lecture 28 - Permanent and Determinant Functions

Lecture 29 - Permanent is hard for #P

Lecture 30 - Interactive Proofs

Lecture 31 - Graph Non-Isomorphism is in IP[2]

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[Lecture 33 - MA is in AM](#)

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[Lecture 39 - Communication Complexity - I](#)

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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-Szemerédi 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

- 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 - Expectation
- Lecture 10 - Conditional Expectation
- Lecture 11 - Important Random Variables
- Lecture 12 - Continuous Random Variables
- Lecture 13 - Equality Checking, Poisson Distribution
- Lecture 14 - Concentration Inequalities, 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
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- Lecture 24 - Random Sampling
- Lecture 25 - Biased Coin Tosses, Hashing
- Lecture 26 - Hashing, Introduction to Probabilistic Methods
- Lecture 27 - Ramsey Numbers, Large Cuts in Graphs
- Lecture 28 - Sum Free Subsets, Discrepancy
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- Lecture 31 - Streaming Algorithms - I

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Lecture 3 - Shannon's Theorem

Lecture 4 - Riordon-Shannon Theorem

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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

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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

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 Theorem) - I
- Lecture 39 - Circuit Lower Bound for Parity by Approximating Circuits using Polynomials (Razborov-Smolensky Theorem) - II
- Lecture 40 - Circuit Lower Bound for Parity by Approximating Circuits using Polynomials (Razborov-Smolensky Theorem) - III
- 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-Hertramph Theorem) - I
- Lecture 54 - Uniform AC0 can be simulated by depth 3 Threshold circuits of quasipolynomial size (Allender-Hertramph Theorem) - II
- 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

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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- 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
- Lecture 30 - Complementary Slackness
- Lecture 31 - Introduction to Algorithmic Game Theory

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[Lecture 33 - Minimax and Nash Equilibrium](#)

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[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](#)

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[Lecture 48 - Linear Regression through LP](#)

[Lecture 49 - Linear Classifiers through LP](#)

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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

Lecture 30 - #P-Hard: Analyse XOR

Lecture 31 - Valiant-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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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

DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : NOC:Practical Cyber Security for Cyber Security Practitioners (Computer Science and Engineering)

Co-ordinators : Prof. Sandeep K. Shukla

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

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Co-ordinators : Prof. Sudeshna Sarkar, Prof. Anupam Basu

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- 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 - Cloudeconomics-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
- 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

DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : NOC:Problem Solving through Programming in C (Computer Science and Engineering)

Co-ordinators : Prof.Arnab sarkar, Prof.Jatindra Kumar Deka, Dr. Santosh Biswas

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 Operatoers in Branching

Lecture 15 - Branching : IF-ELSE Statement

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

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 : Context Bubble Sort](#)

[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](#)

Lecture 1 - Introduction

Lecture 2 - Basics of Task scheduling

Lecture 3 - Cyclic executives

Lecture 4 - Cyclic Scheduler

Lecture 5 - Cyclic Scheduler

Lecture 6 - Exercises on Frame size Selection

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

- 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 : Encoding schemes
- Lecture 17 - GA operator : encoding scheme (Continued...)
- Lecture 18 - GA Operator : Selection
- Lecture 19 - GA Operator : Selection (Continued...)
- Lecture 20 - GA Operator : Crossover techniques
- Lecture 21 - GA Operator : Crossover (Continued...)
- Lecture 22 - GA Operator : Crossover (Continued...)
- Lecture 23 - GA Operator : Mutation and others
- 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
- 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](#)

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

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](#)

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: Storage

Lecture 25 - Storage and File Structure/2: File Structure

Lecture 26 - Indexing and Hashing/1 : Indexing/1

Lecture 27 - Indexing and Hashing/2 : Indexing/2

Lecture 28 - Indexing and Hashing/3 : Indexing/3

Lecture 29 - Indexing and Hashing/4 : Hashing

Lecture 30 - Indexing and Hashing/5 : Index Design

Lecture 31 - Transactions/1

[Lecture 32 - Transactions/2 : Serializability](#)

[Lecture 33 - Transactions/3 : Recoverability](#)

[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 : Processing](#)

[Lecture 39 - Query Processing and Optimization/2 : Optimization](#)

[Lecture 40 - Course Summarization](#)

[Lecture 41 - Live Session](#)

[Lecture 42 - Live Session - 2](#)

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

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 - Interaction 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 - Equivalence Class Testing - I

Lecture 49 - Equivalence 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

DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : NOC:Computer Networks and Internet Protocol (Computer Science and Engineering)

Co-ordinators : Prof. Sandip Chakraborty, Prof. Soumya Kanti Ghosh

- 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)
- 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: Physical Layer](#)
- [Lecture 56 - Layer 1: Physical Layer - II](#)
- [Lecture 57 - Layer 1: Physical Layer - III](#)
- [Lecture 58 - Network Security - Overview](#)
- [Lecture 59 - Network Security - II](#)
- [Lecture 60 - Network Security - III \[TCP/IP Security\]](#)

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NPTEL : NOC:Blockchain Architecture Design and Use Cases (Computer Science and Engineering)

Co-ordinators : Praveen Jayachandran, Prof. Sandip Chakraborty

- 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
- 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

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

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 : NOC:Scalable Data Science (Computer Science and Engineering)

Co-ordinators : Prof. Sourangshu Bhattacharya, Prof. Anirban Dasgupta

Lecture 1 - Background: Introduction

Lecture 2 - Probability: Concentration inequalities

Lecture 3 - Linear algebra: PCA, SVD

Lecture 4 - Optimization: Basics, Convex, GD

Lecture 5 - Machine Learning: Supervised, generalization, feature learning, clustering.

Lecture 6 - Memory-efficient data structures: Hash functions, universal / perfect hash families

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: Space Saving and Count Min

Lecture 12 - Frequent Element: Count Sketch

Lecture 13 - Near Neighbors

Lecture 14 - Locality Sensitive Hashing

Lecture 15 - Building LSH Tables

Lecture 16 - Approximate near neighbors search: Extensions e.g. multi-probe, b-bit hashing, Data dependent variants

Lecture 17 - Approximate near neighbors search: Extensions e.g. multi-probe, b-bit hashing, Data dependent variants (Continued...)

Lecture 18 - Approximate near neighbors search: Extensions e.g. multi-probe, b-bit hashing, Data dependent variants (Continued...)

Lecture 19 - Randomized Numerical Linear Algebra: Random projection

Lecture 20 - Randomized Numerical Linear Algebra: Random projection (Continued...)

Lecture 21 - Randomized Numerical Linear Algebra: a) Matrix multiplication + QB decomposition

Lecture 22 - Randomized Numerical Linear Algebra: b) CUR+CX

Lecture 23 - Randomized Numerical Linear Algebra: a) L2 regression using RP

Lecture 24 - Randomized Numerical Linear Algebra: b) Leverage scores

Lecture 25 - Randomized Numerical Linear Algebra: c) Hash Kernels + Kitchen Sink

Lecture 26 - Map-reduce and Hadoop

Lecture 27 - Hadoop System

Lecture 28 - Hadoop System (Continued...)

Lecture 29 - Hadoop System (Continued...)

Lecture 30 - Spark

Lecture 31 - Spark (Continued...)

[Lecture 32 - Spark \(Continued...\)](#)

[Lecture 33 - Distributed Machine Learning and Optimization: Introduction](#)

[Lecture 34 - SGD+Proof](#)

[Lecture 35 - SGD+Proof \(Continued...\)](#)

[Lecture 36 - Distributed Machine Learning and Optimization:ADMM + applications](#)

[Lecture 37 - Distributed Machine Learning and Optimization:ADMM + applications \(Continued...\)](#)

[Lecture 38 - Clustering](#)

[Lecture 39 - Clustering \(Continued...\)](#)

[Lecture 40 - Conclusion](#)

[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](#)

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NPTEL : NOC:Embedded System Design with ARM (Computer Science and Engineering)

Co-ordinators : Prof. Indranil Sengupta, Prof. Kamalika Datta

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- 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
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- Lecture 31 - Experiments With Relay

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Lecture 9 - Advanced Encryption Standard (AES) and Side Channel Analysis

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NPTEL : NOC:Introduction to Industry 4.0 and Industrial Internet of Things (Computer Science and Engineering)

Co-ordinators : Prof. Sudip Misra

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Lecture 2 - Introduction: IoT Connectivity - Part 1

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Lecture 4 - Introduction: IoT Networking - Part 1

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Lecture 7 - Industry 4.0: Sustainability Assessment of Manufacturing Industry

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Lecture 9 - Industry 4.0: Smart and Connected Business Perspective

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Lecture 12 - Industry 4.0: Collaboration Platform and Product Lifecycle Management

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- Lecture 53 - IIoT Applications: Facility Management
- Lecture 54 - IIoT Applications: Oil, Chemical and Pharmaceutical Industry
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Lecture 21 - Multilayer Perceptron - I

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NPTEL : NOC:Google Cloud Computing Foundation Course (Computer Science and Engineering)

Co-ordinators : Prof. Soumya Kanti Ghosh

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Co-ordinators : Prof. Kamala Krithivasan

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Co-ordinators : Prof. Hema A Murthy, Prof. Shankar Balachandran, Dr. N.S. Narayanaswamy

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Lecture 2 - Review of Structures, Pointers and Functions

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Lecture 4 - Abstract Data Types-Data + Methods

Lecture 5 - List Data Type

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Lecture 13 - Merging using Queue ADT and Queue types

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Lecture 15 - Binary Tree ADT and traversals

Lecture 16 - Tree Applications

Lecture 17 - Binary Search Trees

Lecture 18 - Heaps

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Lecture 4 - Example: Document similarity

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Lecture 6 - Input size, worst case, average case

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Lecture 13 - Merge sort

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Lecture 15 - Quicksort

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Lecture 19 - Representing graphs

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Lecture 21 - Depth first search (DFS)

Lecture 22 - Applications of BFS and DFS

Lecture 23 - Directed acyclic graphs: topological sort

Lecture 24 - Directed acyclic graphs: longest paths

Lecture 25 - Single source shortest paths: Dijkstra's algorithm

Lecture 26 - Dijkstra's algorithm: analysis

Lecture 27 - Negative edge weights: Bellman-Ford algorithm

Lecture 28 - All pairs shortest paths

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- Lecture 32 - Union-Find using arrays
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- Lecture 36 - Heaps: Updating values, sorting
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- 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: minimizing lateness
- Lecture 43 - Huffman codes
- Lecture 44 - Introduction to dynamic programming
- Lecture 45 - Memoization
- Lecture 46 - Grid Paths
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- Lecture 48 - Edit distance
- Lecture 49 - Matrix multiplication
- Lecture 50 - Linear Programming
- Lecture 51 - LP modelling: Production Planning
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- Lecture 53 - Network Flows
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- Lecture 55 - Checking Algorithms
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DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : NOC:Programming, Data Structures and Algorithms (Aricent) (Computer Science and Engineering)

Co-ordinators : Dr. N S. Narayanaswamy, Prof. Shankar Balachandran, Prof. Hema A Murthy

- 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
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- 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
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- Lecture 22 - Recursive Functions
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- Lecture 24 - Complexity Analysis using Sum and Product Rule
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Lecture 4 - Instruction Set Principles-Part 2

Lecture 5 - Instruction Set Principles-Part 3

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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

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Lecture 15 - Fundamentals of Pipelining - Part 3

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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

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Lecture 25 - Tomasulo Algorithm

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Lecture 28 - Multicore Processor Architecture

Lecture 29 - Cache Coherence

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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

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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...

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Lecture 4 - Running Haskell programs

Lecture 5 - Currying

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Lecture 8 - Functions on lists

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Lecture 10 - Tuples

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Lecture 12 - Polymorphism and higher-order functions

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Lecture 14 - List comprehension

Lecture 15 - Folding through a list

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Lecture 17 - Sorting

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Lecture 20 - Defining functions in ghci

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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

NPTEL : Virtual Reality ()

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...)

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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

Lecture 30 - Lens aberrations

Lecture 31 - Optical system of eyes

Lecture 32 - Photoreceptors

- Lecture 33 - Sufficient resolution for VR
- Lecture 34 - Light intensity
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- 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

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DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : NOC:Introduction to Machine Learning (Sponsored by Arihant) (Computer Science and Engineering)

Co-ordinators : Dr. Balaraman Ravindran

- 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
- Lecture 30 - SVM - Hinge Loss Formulation
- Lecture 31 - Weka Tutorial

- Lecture 32 - Early Models
- Lecture 33 - Backpropagation - I
- Lecture 34 - Backpropagation - 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
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Lecture 2 - Abductive Inferences and Expectations

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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

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Lecture 14 - Entailment and Proof

Lecture 15 - The Languages of Logic

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Lecture 19 - Propositional Logic: Syntax

Lecture 20 - Propositional Logic: Semantics

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Lecture 22 - The Deduction Theorem

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Lecture 25 - First Order Logic

Lecture 26 - First Order Logic: Syntax

Lecture 27 - FOL: Universal Instantiation

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Lecture 48 - Prolog: Procedural Interpretation

Lecture 49 - Prolog: Query Evaluation

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- 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: Introduction
- 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
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- Lecture 16 - Memory Segmentation Deep dive - Part 1
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Lecture 2 - Conditional probability

Lecture 3 - Example problems

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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

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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

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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

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Lecture 2 - Tutorial 1 - Probability Basics 2

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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 - L_p Convergence

Lecture 28 - Value Iteration

Lecture 29 - Policy Iteration

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](#)

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

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](#)

DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : NOC:Programming, Data Structures and Algorithms in Python (Computer Science and Engineering)

Co-ordinators : Prof. Madhavan Mukund

- Lecture 1 - Lecture 1 - Algorithms and programming: simple gcd
- 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
- 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](#)

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: Spear phishing

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

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](#)

Lecture 1 - Java Basics

Lecture 2 - Java : Primitive Data Types, Strings, Loops, Conditional Statements

Lecture 3 - Java : Strings, OOP principles

Lecture 4 - Java : Interfaces

Lecture 5 - Java : Classes, Exceptions, Threads

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

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](#)

DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : NOC:Introduction to Modern Application Development (Computer Science and Engineering)

Co-ordinators : Tanmai Gopal, Prof. Gaurav Raina

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 - Introduction 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

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](#)

[Lecture 36 - Version Control using Git](#)

[Lecture 37 - Backend Architectures](#)

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: Basic Commands

Lecture 16 - Linux: Basic Commands (Continued...)

Lecture 17 - Linux: Users and Permissions

Lecture 18 - Linux: I/O Redirection and Pipes

Lecture 19 - Linux: Task Control

Lecture 20 - Linux: Shell Environment

Lecture 21 - Linux: Text Editors

Lecture 22 - Linux: Compression / Archiving

Lecture 23 - Linux: Print and Sync Commands

Lecture 24 - Linux: File Comparison

Lecture 25 - Basic Networking Administration

Lecture 26 - Filesystems and Devices

Lecture 27 - Shell Introduction

Lecture 28 - Shell Comments and Variables

Lecture 29 - Shell Variables

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](#)

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 - Gaschnig's Backjumping: The Culprit Variable

Lecture 30 - Gaschnig'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](#)

Lecture 1 - Introduction High Speed Circuit - Design Recursive Doubling

Lecture 2 - High Speed Circuit Design - Fast Adder Circuits

Lecture 3 - Lab 1 : Introduction

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 : Segmentation - Part I

Lecture 14 - Lab 2 : Segmentation - Part II

Lecture 15 - Lab 2 : Segmentation - Part III

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 : Instruction Scheduling - Static and Dynamic

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

Lecture 30 - Global Branch Prediction

Lecture 31 - Structural Hazard, Architectural Enhancements

[Lecture 32 - Lab 3 : Virtual Memory](#)

[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 : Task Switching \(Continued...\)](#)

[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 : Recent Trends in Computer Organization and Architecture](#)

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

Lecture 30 - Practical Channel Models (ITU, COST), Computer generation of Rayleigh fading

Lecture 31 - Rayleigh Fading simulation - Clark and Gans Method, Jakes's™ Method

[Lecture 32 - Jakes's™ 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](#)

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[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](#)

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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: A Peer-to-Peer Electronic Cash System

Lecture 27 - Case Study 10 - BlockChain Technology

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: The Challenge

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 : Different Formats

Lecture 20 - Datasets : How to Download?

Lecture 21 - Datasets : Analysing Using Networkx

Lecture 22 - Datasets : Analysing Using Gephi

Lecture 23 - Introduction : Emergence of Connectedness

Lecture 24 - Advanced Material : Emergence of Connectedness

Lecture 25 - Programming Illustration : Emergence of Connectedness

Lecture 26 - Summary to Datasets

Lecture 27 - Introduction

Lecture 28 - Granovetter's Strength of weak ties

Lecture 29 - Triads, clustering coefficient and neighborhood overlap

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 longitudinal data](#)

[Lecture 54 - Spatial Segregation : An Introduction](#)

[Lecture 55 - Spatial Segregation : Simulation of the Schelling Model](#)

[Lecture 56 - Spatial Segregation : Conclusion](#)

[Lecture 57 - Schelling Model Implementation - 1 \(Introduction\)](#)

[Lecture 58 - Schelling Model Implementation - 2 \(Base Code\)](#)

[Lecture 59 - Schelling Model Implementation - 3 \(Visualization and Getting a list of boundary and internal nodes\)](#)

[Lecture 60 - Schelling Model Implementation - 4 \(Getting a list of unsatisfied nodes\)](#)

[Lecture 61 - Schelling Model Implementation - 5 \(Shifting the unsatisfied nodes and visualizing the final graph\)](#)

[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
- Lecture 69 - Outline of implementation
- 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
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- Lecture 84 - Implementing PageRank Using Random Walk Method - 1
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- 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
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- Lecture 119 - Rich Get Richer Phenomenon
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- Lecture 121 - Implementing Rich-getting-richer Phenomenon (Barabasi-Albert Model) - 1
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- Lecture 123 - Implementing a Random Graph (Erdos-Renyi Model) - 1
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- Lecture 126 - Rich Get Richer - A Possible Reason
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- [Lecture 159 - PseudoCores : Introduction](#)
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- [Lecture 161 - Who are the right key nodes?](#)
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Lecture 3 - Introduction to Probability - Verifying Matrix Multiplication (Statement, Algorithm and Independence)

Lecture 4 - Introduction to Probability - Verifying Matrix Multiplication (Correctness and Law of Total Probability)

Lecture 5 - Introduction to Probability - How Strong is your Network?

Lecture 6 - Introduction to Probability - How to Understand the World? Play with it!

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Lecture 8 - Tutorial 2

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Lecture 10 - Discrete Random Variables - Linearity of Expectation and Jensen's Inequality

Lecture 11 - Discrete Random Variables - Conditional Expectation I

Lecture 12 - Discrete Random Variables - Conditional Expectation II

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Lecture 14 - Discrete Random Variables - Randomized Selection

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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

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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 Routing

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Lecture 25 - Live Session 2

Lecture 26 - Live Session

DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : NOC:Introduction to Human Computer Interaction (Computer Science and Engineering)

Co-ordinators : Prof. Ponnurangam Kumaraguru

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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

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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: Low fidelity and High fidelity

Lecture 14 - User-Centered Design

Lecture 15 - Lab Session: Task Analysis

Lecture 16 - Design Patterns

Lecture 17 - Lab Session: Material Design

Lecture 18 - Usable security

Lecture 19 - Lab Session: Task Analysis - 2

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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[Lecture 2 - WISE Gen and The IT Revolution - 1 \(Continued...\)](#)

[Lecture 3 - WISE GEN - Next Step](#)

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[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](#)

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[Lecture 18 - Serverside Attacks: Tools in Kali Linux \(Continued...\)](#)

[Lecture 19 - Serverside Attacks: Tools in Kali Linux \(Continued...\)](#)

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[Lecture 21 - Serverside Attacks: Tools in Kali Linux \(Continued...\)](#)

[Lecture 22 - Serverside Attacks: Tools in Kali Linux \(Continued...\)](#)

[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](#)

[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](#)
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- [Lecture 35 - Technical Fundamentals for Evidence Acquisition - 1](#)
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- [Lecture 37 - Packet Capture Tools and Methods](#)
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- [Lecture 39 - Packet Analysis](#)
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- [Lecture 43 - Wireless Forensics - Technology](#)
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- [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](#)
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Lecture 6 - Recasting and joining of dataframes

Lecture 7 - Arithmetic,Logical and Matrix operations in R

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Lecture 10 - Control structures

Lecture 11 - Data visualization in R Basic graphics

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Lecture 13 - Solving Linear Equations

Lecture 14 - Solving Linear Equations (Continued...)

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Lecture 16 - Linear Algebra - Distance,Hyperplanes and Halfspaces,Eigenvalues,Eigenvectors (Continued... 1)

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Lecture 24 - Unconstrained Multivariate Optimization

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Lecture 26 - Gradient (Steepest) Descent (OR) Learning Rule

Lecture 27 - Multivariate Optimization With Equality Constraints

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Lecture 30 - Solving Data Analysis Problems - A Guided Thought Process

Lecture 31 - Module : Predictive Modelling

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[Lecture 34 - Diagnostics to Improve Linear Model Fit](#)

[Lecture 35 - Simple Linear Regression Model Building](#)

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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?

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Lecture 10 - How to give instructions ?

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Lecture 13 - More About Loops

Lecture 14 - Solution To Looping Problem

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Lecture 17 - Scratch : Animation 3

Lecture 18 - More On Scratch

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Lecture 20 - Installation of Anaconda

Lecture 21 - Introduction to Spyder IDE

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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

Lecture 30 - Understanding if condition's working

Lecture 31 - Realizing the importance of syntax and indentation

Lecture 32 - Introductions to loops

Lecture 33 - Loops: Sum of numbers

Lecture 34 - Loops: Sum of numbers (Continued...)

Lecture 35 - Loops: Multiplication Tables

Lecture 36 - Introduction to While Loop

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Lecture 64 - Dobble Game - Spot the similarity 02

- Lecture 65 - Dobble Game - Spot the similarity 03
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- Lecture 67 - What is your date of birth?
- Lecture 68 - Birthday Paradox - Find your twin 01
- Lecture 69 - Birthday Paradox - Find your twin 02
- Lecture 70 - Birthday Paradox - Find your twin 03
- Lecture 71 - Birthday Paradox - Find your twin 04
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- Lecture 73 - What's your favourite movie?
- Lecture 74 - Guess the Movie Name 01
- Lecture 75 - Guess the Movie Name 02
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- Lecture 86 - Rock, Paper and Scissor : Cheating not allowed !! 01
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- Lecture 90 - Sorting and Searching : 20 questions game 01
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- 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
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Co-ordinators : Prof. Ganapathy, Prof. Balaji Srinivasan

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NPTEL : NOC:Machine Learning (Computer Science and Engineering)

Co-ordinators : Prof. Henrik Bostrom, Prof. Fredrik Kilander, Prof. Carl Gustaf Jansson

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DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : NOC:Applied Accelerated Artificial Intelligence (Computer Science and Engineering)

Co-ordinators : Prof. Satyadhyan Chickerur, Prof. Bharatkumar Sharma, Prof. Adesuyi Tosin, Prof. Satyajit Das

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DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : ACM India - RBCDSAI Summer School on DS-AI-ML (Computer Science and Engineering)

Co-ordinators : Multi-Faculty

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NPTEL : NOC:Responsible and Safe AI Systems (Computer Science and Engineering)

Co-ordinators : Prof. Ponnurangam Kumaraguru, Prof. Balaraman Ravindran, Prof. Arun Rajkumar

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