MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

Syllabus for Information Technology

Design & Analysis of Algorithm

Course Code: IT501

Contact: 3L + 1T

Credits: 4

Complexity Analysis:[2L]
Time and Space Complexity, Different Asymptotic notations – their mathematical significance
Algortihm Design Techniques:
Divide and Conquer: [3L]
Basic method, use, Examples – Binary Search, Merge Sort, Quick Sort and their complexity Heap Sort and its complexity .
Dynamic Programming: [3L]
Basic method, use, Examples – Matrix Chain Manipulation, All pair shortest paths, single source shortest path.
Backtracking: [2L]
Basic method, use, Examples – 8 queens problem, Graph coloring problem.
Greedy Method: [3L]
Basic method, use, Examples – Knapsack problem, Job sequencing with deadlines, Minimum cost spanning tree by Prim's and Kruskal's algorithm.
Lower Bound Theory:[1L]
O(nlgn) bound for comparison sort
Disjoint set manipulation:[2L]
Set manipulation algorithm like UNION-FIND, union by rank.
Graph traversal algorithm: Recapitulation[1L]
Breadth First Search(BFS) and Depth First Search(DFS) – Classification of edges - tree, forward, backward cross edges – complexity and comparison
String matching problem:[3L]
Different techniques – Naive algorithm, string matching using finite automata, and Knuth, Morris, Pratt (KMP) algorithm with their complexities.
Amortized Analysis:[3L]
Aggregate, Accounting, and Potential Method.
Network Flow: [3L]
Ford Fulkerson algorithm, Max-Flow Min-Cut theorem (Statement and Illustration)
Matrix Manipulation Algorithm:[3L]
Strassen's matrix manipulation algorithm; application of matrix multiplication to solution of simultaneous linear equations using LUP decomposition, Inversion of matrix and Boolean matrix multiplication

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Syllabus for Information Technology

Design & Analysis of Algorithm

Notion of NP-completeness:[3L]

P class, NP class, NP hard class, NP complete class – their interrelationship, Satisfiability problem, Cook's theorem (Statement only), Clique decision problem

Approximation Algorithms:[3L]

Necessity of approximation scheme, performance guarantee, polynomial time approximation schemes, vertex cover problem, travelling salesman problem.

Text Book:

1. T. H. Cormen, C. E. Leiserson, R. L. Rivest and C. Stein, "Introduction to Algorithms"
2. A. Aho, J.Hopcroft and J.Ullman "The Design and Analysis of Algorithms"
3. D.E.Knuth "The Art of Computer Programming", Vol. 3
4. Jon Kleiberg and Eva Tardos, •Algorithm Design•

Reference:

1. K.Mehlhorn , "Data Structures and Algorithms" - Vol. I & Vol. 2.
2. S.Baase "Computer Algorithms"
3.E.Horowitz and Shani "Fundamentals of Computer Algorithms"
4.E.M.Reingold, J.Nievergelt and N.Deo- "Combinational Algorithms- Theory and Practice", Prentice Hall, 1997

B. P. Poddar Institute of Management & Technology
Department of Information Technology
Lesson Plan
Academic Year: 2018-19 Semester: Odd

Course Name: Design & Analysis of Algorithm
Course Code: IT501
Class : IT 3rd Year

Lecture No.	Topic	Text Book	Text & Web References	Teaching Methods	Teaching Aids
L1	Time and Space Complexity, Different Asymptotic notations – their mathematical	T1,T2	R1,R3, W1,W3	Lecturing	Whiteboard
L2	Algorithm Design Techniques: Divide and Conquer: Basic method, use	T1,T2	R1,R3, W1,W3	Lecturing, PPT , Think pair Share	LCD Projector, Desktop
L3	Binary Search	T1	R1,R3, W1,W3	Lecturing	LCD Projector, Desktop
TI	Problems on time & space complexity.Average Case Time Complexity			Tutorial Method Lecturing	Whiteboard Markar Pen
L4	Merge Sort and its complexity	T1	R1,R3, W1,W3	PPT, Lecturing	LCD Projector, Desktop
L5	Quick Sort and its complexity	T1,T3	R1,R3, W1,W3	PPT, Lecturing	LCD Projector, Desktop
L6	Heap Sort and its complexity	T1,T3	R1,R3, W1,W3	PPT, Lecturing	LCD Projector, Desktop
T2	Comparative study of different sorting algorithms			Group Discussion,	LMS Whiteboard
L7	Dynamic Programming: Basic method, use,	T1,T3	R1,R3, W1,W3	PPT, Lecturing	LCD Projector, Desktop
L8	Matrix Chain Manipulation	T1,T3	R1,R3, W2,W3	Lecturing	Whiteboard
L9	All pair shortest paths	T1,T2	R1,R3, W2,W3	PPT, Lecturing	LCD Projector, Desktop
T3	Q&A on Dynamic Programming Concepts			Quiz	LMS
L10	Single source shortest path.	T1,T2	R1,R3, W1,W3	PPT, Lecturing	LCD Projector, Desktop
L11	Backtracking: Basic method, use,	T1,T2	R1,R2,W1,W 3	PPT, Lecturing	LCD Projector, Desktop
L12	8 queens problem,	T1,T3	R2,R3, W1,W3	Lecturing	Whiteboard
T4	Problem solving using Backtracking strategies			Tutorial Method	Whiteboard
L13	Graph coloring problem	T1,T3	R1,R3,W1,W 3	Lecturing	Whiteboard
L14	Greedy Method, Basic method, use	T1,T2	R1,R3, W1,W3	Lecturing	Whiteboard
L15	Knapsack problem	T1,T2	R1,R3, W1,W3	Lecturing	Whiteboard
T5	Comparative analysis of backtracking and Divide & Conquer strategies.			Group Discussion,Quiz	LMS

L16	Job sequencing with deadlines	T1,T3	R1,R3, W1,W3	Lecturing	Whiteboard
Lecture No.	**Topic**	**Text Book**	**Text & Web References**	**Teaching Methods**	**Teaching Aids**
L17	Minimum cost spanning tree by Prim's algorithm	T1,T3	R1,R2, W2,W3	PPT, Lecturing	LCD Projector, Desktop
L18	Minimum cost spanning tree by Kruskal's algorithm	T1,T3	R1,R3 W1,W3	PPT, Lecturing	LCD Projector, Desktop
T6	Problem practice on MST .			Tutorial Method	Whiteboard
L19	Lower Bound Theory: O(nlgn) bound for comparison sort	T1,T3	R1,R3 W1,W3	Lecturing	Whiteboard Markar Pen
L20	Disjoint set manipulation algorithm like UNION, FIND, union by rank.	T1,T3	R1,R3 W1,W3	Lecturing	Whiteboard Markar Pen
L21	Graph traversal algorithm: Breadth First Search(BFS)	T1,T3	R1,R3, W1,W2	PPT,Lecturing	LCD Projector Whiteboard
T7	Group Discussion on lower bound theory			Group Discussion	Whiteboard
L22	Depth First Search(DFS)	T1,T3	R1,R3, W2,W3	PPT,Lecturing	Whiteboard
L23	Classification of edges- tree, forward, back and cross edges – complexity and	T1,T2	R1,R3, W1,W3	PPT,Lecturing	Whiteboard
L24	String matching problem: Naive algorithm	T1,T2	R2,R3, W1,W3	Lecturing	Whiteboard
T8	Q&A on DFS & BFS			Quiz	LMS
L25	String matching using finite automata, and Knuth, Morris	T1,T2	R1,R3, W1,W3	Lecturing	Whiteboard
L26	Pratt (KMP) algorithm with their complexities.	T1,T3	R1,R3, W1,W3	Lecturing	Whiteboard
L27	Amortized Analysis: Aggregate Method, Accounting Method & Potential Method.	T1,T3	R1,R3, W2,W3	Lecturing	Whiteboard
T9	Q&A on applications of Automata theory in algorithm analysis			Quiz	LMS
L28	Network Flow: Ford Fulkerson algorithm,Max Flow Min Cut theorem	T1,T3	R1,R3, W2,W3	Lecturing	Whiteboard
L29	Matrix Manipulation Algorithm: Strassen's matrix manipulation algorithm	T1,T3	R1,R3, W1,W3	PPT, Lecturing	LCD Projector, Desktop
L30	Application of matrix multiplication to solution of simultaneous linear equations	T1,T3	R1,R3, W1,W3	Lecturing	Whiteboard
T10	Applications of Ford Fulkerson algorithms & Strassen's matrix manipulation algorithm			Lecturing	Whiteboard
L31	Inversion of matrix and Boolean matrix multiplication	T1,T3	R1,R3, W1,W3	Lecturing	Whiteboard
L32	Notion of NP-completeness: P class, NP class, NP hard class, NP complete class –	T1,T3	R1,R3, W1,W3	PPT, Lecturing	LCD Projector, Desktop
L33	Cook's theorem (Statement only), Clique decision problem .Approximation	T1,T3	R1,R3, W1,W3	Lecturing	Whiteboard
T11	Quiz on NP-Completeness			Quiz	LMS
L34	Necessity of approximation scheme, performance guarantee	T1,T3	R1,R3, W1,W3	Lecturing	Whiteboard Markar Pen
L35	Polynomial time approximation schemes, vertex cover problem,	T1,T2	R1,R3, W2,W3	Lecturing	Whiteboard Markar Pen
L36	Traveling salesman problem.	T1,T3	R1,R3, W1,W3	PPT, Lecturing	LCD Projector, Desktop

T12	Q&A on optimization based strategies			Quiz	LMS

Text Book:

T1 : T. H. Cormen, C. E. Leiserson, R. L. Rivest and C. Stein, “Introduction to Algorithms”
T2 : Aho, J.Hopcroft and J.Ullman “The Design and Analysis of Algorithms”
T3 : D.E.Knuth “The Art of Computer Programming”, Vol. 3
T4 : Jon Kleiberg and Eva Tardos, "Algorithm Design".

Text Reference:

R1 : K.Mehlhorn , “Data Structures and Algorithms” Vol. I & Vol. 2.
R2 : S.Baase “Computer Algorithms”
R3 : E.Horowitz and Shani “Fundamentals of Computer Algorithms”
R4 : E.M.Reingold, J.Nievergelt and N.Deo“Combinational AlgorithmsTheory and Practice”, Prentice Hall

Web Reference:

W1: http://nptel.ac.in/courses/106101060/.
W2: http://www.facweb.iitkgp.ernet.in/~sourav/daa.html.
W3: http://openclassroom.stanford.edu/MainFolder/CoursePage.php?course= IntroToAlgorithms.

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B. P. Poddar Institute of Management & Technology
Department of Information Technology
Lesson Plan
Academic Year: 2018-19 Semester: Odd

Assistant Prof. Dept of IT

B. P. Poddar Institute of Management & Technology
Department of Information Technology
Academic Year: 2018-19 Semester: Odd

Course Name: Design and Analysis of Algorithm

Course Code: IT501

Course Outcomes:

IT501.1	Understand the asymptotic performance analysis of algorithms.
IT501.2	Familiar with major algorithms design techniques (brute-force, divide and conquer, greedy, etc.)
IT501.3	Evaluate various searching, sorting and graph traversal algorithms.
IT501.4	Apply Amortized Analysis,Network Flow and Matrix multiplication algorithm concepts in problem solving.
IT501.5	Analyze NP ,NP complete problems and approximation algorithms

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
IT501.1	2													
IT501.2	2	2	2	2								1	2	
IT501.3	2	2	2	2								1	2	
IT501.4	2	2	2	2								1	2	
IT501.5	2	2	3	3								1	2	
IT501	**2**	**1.6**	**1.8**	**1.8**								**0.8**	**2**	