CO3463: Design and Analysis of Algorithms

Theory:

1. Review of elementary Data Structures: Stacks, Queues, Lists, Trees, Hash, Graph. Internal representation of Data Structures, Code tuning techniques: Loop optimization, Data transfer optimization, Logic optimization.
2. Definitions of complexity, Time and Space Complexity; Time space tradeoff, various bounds on complexity, asymptotic notation: O-notation, Ω-notation, Θ-notation, recurrences and recurrences solving techniques: recursion-tree method and master method, Average time analysis methods: Probabilistic methods.
3. Design and analysis of algorithms using the brute-force, greedy, dynamic programming, divide-and-conquer and backtracking techniques.
4. Algorithm for sorting and searching, Randomized Algorithms, Number-theoretic algorithms, Matrix Manipulation algorithms, Graph Algorithms: BFS and DFS.
5. NP-hard and NP-complete problems, Approximations Algorithms, Data Stream Algorithms, Design and Complexity of Parallel Algorithms and Semi-Numerical Algorithms.

Books Recommended

1. Cormen, Leisersam, Rivest Stein, Introduction to Algorithms, Second Edition, Pretice Hall of India.,2001
2. Aho A.V., Hopcorft J.E., J. Ullman, Design and Analysis of Computer Algorithms, Addision Vesley.1998
3. Horowitz E. and Sahani, Fundamentals of Computer Algorithms, Galgotia Publication, 1984

References Recommended

1. Knuth D., Fundamental algorithms: The art of Computer programming, Volume – I, Third Edition, Pearson Education. 1998
2. Knuth D., Seminumerical Algorithms: The art of Computer programming, Volume – II, Third Edition, Pearson Education. 1998
3. Knuth D., Sorting and Searching: The art of Computer programming, Volume – III, Second Edition Pearson Education. 1998
4. John Kleinberg, Trades E., Algorithm Design, Pearson Education. 2002.
5. A. Papoulis, S.U. Pillai, Probability, Random variables and stochastic processes, McGraw Hill. Fourth Edition 2006
6. Michael T. Goodrich, Roberto Tamassi, Algorithm Design, Willey India edition 2009.

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Lecture Plan

S.NO	Topics	No of Lectures
1.	Introduction	3
2.	Asymptotic notation	2
3.	Divide and conquer	3
4.	Recurrences	3
5.	Greedy Methods	2
6.	Dynamic programming	3
7.	Backtracking	2
8.	Randomized Algorithms	2
9.	NP Problems	3
10.	Code tuning techniques	2
11.	Sorting Algorithms	3
12.	Searching Algorithms	3
13.	Data Structures Algorithms	3
14.	Graph/Tree Algorithm	4
15.	Number-theoretic algorithms	2
16.	Data Stream Algorithms	1
17.	Semi-Numerical Algorithms	1
18.	Parallel algorithm	2
19.	Algorithm Mathematics(Probability Model)	3
20.	Test/Exam paper discussion	3
	Total	**50**

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Detail Lecture Plan

Lec #	Topics
L 1.	Scope of subject, What is covered? And what is not covered?
L 2.	What is algorithm and it's characteristics
L 3.	How to write/express algorithms, and validate an algorithm
L 4.	Analysis attributes/dimensions of an algorithms
L 5.	Asymptotic Notation
L 6.	Recurrence Equation
L 7.	How to define the recurrence relation for a algorithm
L 8.	Recursion tree methods for solving the Recurrence relation
L 9.	Substitution methods for solving the Recurrence relation
L 10.	Master Theorem for solving recurrence equation
L 11.	Code tuning techniques - Introduction
L 12.	Code tuning techniques - Approaches
L 13.	Divide and conquer - Introduction
L 14.	Divide and conquer Algorithms
L 15.	Searching Algorithms Analysis - I (Linear Search)
L 16.	Searching Algorithms Analysis – II (Binary Search)
L 17.	Searching Algorithms Analysis – III (Optimum Searching)
T01	**Test – 01 (2-4 Feb 2017)**
L 18.	Sorting Algorithms Analysis – I (Sequential Sorting)
L 19.	Sorting Algorithms Analysis – II (Non-sequential Sorting)
L 20.	Sorting Algorithms Analysis – III (Optimum sorting)
L 21.	Linear Data structures – Stack, Queue and Link List
L 22.	Non linear Data structure - Introduction
L 23.	Non linear Data structure – Graph
L 24.	Graph Algorithms - I (Traversing Algorithms)
L 25.	Graph Algorithms – II

L 26.	Non linear Data structure - Tree
L 27.	Tree Algorithms
L 28.	Greedy Methods : Introduction
L 29.	Greedy Methods : Knapsack Problem
L 30.	Dynamic programming : Introduction
L 31.	Dynamic programming : Matrix Chain Multiplication
L 32.	Dynamic programming : LCS
L 33.	Backtracking - Introduction
L 34.	Backtracking - Algorithms
T02	**Test – 02 (23-25 March 2017)**
L 35.	Randomized Algorithms
L 36.	Number-theoretic algorithms
L 37.	Semi-Numerical Algorithms
L 38.	Untraceable problems
L 39.	NP Problems – Introduction
L 40.	Approximation Algorithms for NP Problem - I
L 41.	Approximation Algorithms for NP Problem - II
L 42.	Average case analysis of algorithm - Introduction
L 43.	Average Case Analysis using probabilistic model – I
L 44.	Average Case Analysis using probabilistic model - II
L 45.	Data Stream Algorithms
L 46.	Parallel algorithms – I
L 47.	Parallel algorithms - II
T03	**Test – 03 (13-18 April - 2017)**
L 48.	Old Exam Paper Discussion – I
L 49.	Old Exam Paper Discussion – II
L 50.	Old Exam Paper Discussion – III

COURSE POLICIES (Tentative):

Assignments/Tests:

Test - 01	15 %
Test - 02	15 %
Test - 03	15 %
Theory Assignments	15 %
Surprise Quizzes	40 %
Attendance	00 %

Attendance:

For students, attendance is expected for each class meeting.

Assignments:

Will be mailed soon.

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