University of Engineering and Technology Lahore
Course Outline Report
Subject: CS-311 Analysis of Algorithms

Course Description

In this course we will study, introduction to algorithms, the role of algorithms in computing, algorithm design techniques; methods of specification of algorithms, proving an algorithm's correctness, fundamental of the analysis of algorithms efficiency, asymptotic notations, mathematical analysis of non-recursive algorithms, mathematical analysis of recursive algorithms, divide-and-conquer algorithms and recurrences, greedy algorithms, graph algorithms, and dynamic programming.

Course Detail

Contact Hrs.	3.0
Pre-requisite	CS-212 Data Structures and Algorithms,

Measurable Student Learning Outcomes

CLOs	Description	PLOs	Domain	Domain Level
CLO1	Classify algorithms according to their complexity.	PLO02	Cognitive	2. Understand
CLO2	Calculate time and space complexity of algorithms using algorithm analysis techniques	PLO02	Cognitive	3. Apply
CLO3	Demonstrate asymptotic analysis of recursive as well as non-recursive algorithms.	PLO02	Cognitive	3. Apply
CLO4	Design efficient algorithms using various algorithm design techniques	PLO03	Cognitive	6. Create

Text Books

1. Introduction to Algorithms, T. H. Cormen, C. E. Leiserson, R. L. Rivest, and C. D. Stein, MIT Press. 3rd Edition
2. Algorithms by Richard Johnsonbaugh. Marcus Schaefer
3. ParagHimanshu Dave, HimanshuBhalchandra Dave: Design and Analysis of Algorithms
4. Gilles Brassard and Paul Bretly: Fundamentals of Algorithmics, ISBN: 81-203-1131-0

Tentative Weekly Lecture Plan

Week	Topics	CLO(s)
1	Introduction to Algorithms, role of algorithms in computing, methods of specification of algorithms and algorithms as a technology	CLO1
2	Fundamental of the analysis of algorithms efficiency, Asymptotic notations, mathematical analysis of non-recursive algorithms	CLO1, CLO2
3	Description of selection sort, Analysis of selection sort, Analysis of linear search algorithm.	CLO1, CLO2
4	Analysis of Binary search algorithm, mathematical analysis of recursive algorithms, Tower of Hanoi problem	CLO2, CLO3
5	What are Recurrences? Methods to solve recurrences: a. Substitution Method b. Recursion Tree Method c. Master Method	CLO3
6	Sorting and Order Statistics, Heap Sort, Maintaining the heap property, Building a heap, The Heap-Sort Algorithm	CLO2, CLO3
7	Quick Sort: Description and analysis Merge Sort: Description and analysis	CLO2, CLO3
8	Radix Sort: Description and analysis Counting Sort: Description and analysis	CLO2, CLO3
9	Algorithm Design Techniques, Description of Dynamic Programming, Steps required for the Design of Dynamic Programming Algorithms, bottom-up and top-down approach, Multistage graph problem	CLO4
10	Dynamic Programming Examples: Coin row problem, Coin change problem, Rod cutting problem solution through dynamic programming and analysis	CLO4
11	Dynamic Programming Examples, Knapsack problem, Matrix chain multiplication problem, 0/1 Knap sack problem using dynamic programming	CLO4
12	Greedy Algorithms-I: introduction, comparison with DP, Greedy algorithms and analysis for knapsack, Job sequence, Coin change, activity selection problem	CLO3, CLO4
13	Greedy algorithms-II: Examples: optimal merge pattern, Huffman codes (data compression, Minimum spanning tree, Prims and Kruskals algorithms	CLO3, CLO4
14	Single source shortest path problem: Dijekstra's and bellman ford algorithm Pairs Shortest Path problem, Floyd-Warshall algorithm detailed analysis	CLO3, CLO4

15	Graph search: BFS and DFS, backtracking introduction	CLO4
16	Graph search: BFS and DFS, backtracking introduction	CLO4