CSE408:DESIGN AND ANALYSIS OF ALGORITHMS

L:3   T:0   P:0   Credits:3

Course Outcomes: Through this course students should be able to

CO1 :: Understand the basic techniques of analyzing the algorithms using space and time complexity, asymptotic notations

CO2 :: apply the various string matching algorithms

CO3 :: Analyze the divide and conquer algorithm design technique using various problems

CO4 :: Evaluate the various dynamic programming and greedy algorithm design technique to solve various problems

CO5 :: Apply the Approximation Algorithm to solve some classic problems and design technique.

CO6 :: Define intractability (NP-completeness) and understand to solve the optimization problems

Unit I

Foundations of Algorithm : Analysis of algorithm: History and Motivation, A Scientific Approach, Example: Quicksort, Introductions to "big-oh" notation and asymptotic analysis, Recurrence relations : Computing Values, Telescoping, Types of Recurrences, Mergesort , Master Theorem, Overview of generating functions: Ordinary Generating Functions, Counting with Generating Functions, Catalan Numbers, Solving Recurrences, Exponential Generating Functions. Asymptotics: Standard Scale, Manipulating Expansions, Asymptotic of Finite Sums, Asymptotic of Finite Sums., Trees: Trees and Forests, Binary Search Trees, Path Length, Other Types of Trees.

Unit II

String and its Matching Algorithms : Strings and Tries: Bit strings with Restrictions , Languages, Tries, Trie Parameters Key pattern matching concepts: Suffix Tree , Suffix Array, Knuth-Morris-Pratt algorithm

Unit III

Divide and Conquer Technique : What Are Divide and Conquer Algorithms? Max Subarray Problem Using Divide and Conquer, Karatsuba's Multiplication Algorithm , FFT Part 1: Introduction and Complex Numbers,FFT Definition and Interpretation of Discrete Fourier Transforms, FFT: Divide and Conquer Algorithm for FFT, Application # 1 : Fast Polynomial Multiplication using FFT ,Application # 2: Data Analysis using FFT

Unit IV

Dynamic Programming and Greedy Techniques : Introduction to Dynamic Programming + Rod Cutting Problem, Coin Changing Problem, Knapsack Problem, When Optimal Substructure Fails, Dynamic Programming: Longest Common Subsequence, Memorization, Coin Changing Problem. Introduction to Greedy Algorithms ,Greedy Interval Scheduling, Prefix Codes, Huffman Codes, Huffman Codes: Proof of Optimality

Unit V

Approximation Algorithms : Introduction to Approximation Algorithms,: Introduction to Job shop Scheduling and Algorithm Design, Analysis of Job shop Scheduling, Approximation Algorithms for Vertex Cover and their Analysis, Approximation Algorithms for the Maximum Satisfiability Problem, Travelling Salesman Problem and Approximation Schemes: Introduction to TSP and its applications, NP-Hardness of TSPs, Hardness of Approximating General TSPs

Unit VI

Introduction to intractability (NP-completeness) and solving optimization problems. : Decision Problems and Languages, Polynomial Time Problems, NP Definition, NP Completeness and Reductions ,NP Complete Problems: Examples, Computation and Physics ,Qubits and Operations, Bell's Inequality, Grover's Search Algorithm

Text Books:
1. INTRODUCTION TO THE DESIGN AND ANALYSIS OF ALGORITHM by ANANY LEVITIN, PEARSON

2. INTRODUCTION TO THE DESIGN AND ANALYSIS OF ALGORITHM by ANANY LEVITIN, PEARSON

References:
1. INTRODUCTION TO ALGORITHMS by C.E. LEISERSON, R.L. RIVEST AND C. STEIN, THOMAS TELFORD LTD.

References: 2. THE DESIGN AND ANALYSIS OF COMPUTER ALGORITHMS by A.V.AHO, J.E. HOPCROFT AND J.D.ULLMAN, PEARSON

3. COMPUTER ALGORITHMS - INTRODUCTION TO DESIGN AND ANALYSIS by SARA BAASE AND ALLEN VAN GELDER, PEARSON

4. FUNDAMENTALS OF COMPUTER ALGORITHMS by HOROWITZ, S. SAHNI, GALGOTIA PUBLICATIONS