CS-104(New): Design and Analysis of Algorithms

Prerequisites

- Basic algorithms and data structure concepts.
- Basic programming concepts

Objectives

This course will prepare students in

- Basic Algorithm Analysis techniques and understand the use o asymptotic notation
- Understand different design strategies
- Understand the use of data structures in improving algorithm performance
- Understand classical problem and solutions
- Learn a variety of useful algorithms
- Understand classification o problems

Unit 1. Analysis

Algorithm definition, space complexity, time complexity, worst case –best case –average case complexity, asymptotic notation, sorting algorithms (insertion sort, heap sort) , sorting in linear time, searching algorithms, recursive algorithms (Tower of Hanoi , Permutations).

[T1 1.1 , 1.2, 1.3] [6]

Unit 2. Design strategies

Divide and conquer-control abstraction, binary search, merge sort, Quick sort, Strassen's matrix multiplication [T1 3.1, 3.2, 3.4,3.5,3.7] **[6]**

Unit 3. Greedy method- knapsack problem, job sequencing with deadlines,minimum-cost spanning trees**,** Kruskal and Prim's algorithm, optimal storage on tapes, optimal merge patterns, Huffman coding [T1 4.1, 4.2, 4.4, 4.5, 4.6,4.7, 4.8] **[8]**

Unit 4. Dynamic programming- matrix chain multiplication, **.** single source shortest paths, Dijkstra's algorithm, Bellman- ford algorithm , all pairs shortest path, longest common subsequence, string editing, 0/1 knapsack problem, Traveling salesperson problem.

[T1 5.1, 5.3, 5.6, 5.7, 5.9] **[8]**

Unit 5. Decrease and conquer: - DFS and BFS, Topological sorting, connected components

[T6.1, 6.2, 6.3, 6.4] **[6]**

Unit 6. Backtracking: General method, 8 Queen's problem, Sum of subsets problem, graph coloring problem, Hamiltonian cycle

[T1 7.1 , 7.2, 7.3, 7.4, 7.5] [4]

Unit 7. Branch and Bound Technique : FIFO, LIFO, LCBB, TSP problem, 0/1 knapsack problem

[T1 8.1.1, 8.2, 8.3] **[4]**

Unit 8. Transform and conquer:- Horner's Rule and Binary Exponentiation – Problem Reduction –

[T1 9.1, 9.2 ,9.3] [4]

Unit 9. Problem classification

Nondeterministic algorithm, The class of P, NP, NP-hard and NP- Complete problems, significance of Cook's theorem

[T1 11.1] **[2]**

Text Books

T1. Ellis Horowitz, Sartaj Sahni & Sanguthevar Rajasekaran, Computer Algorithms, Galgotia.

T2 T. Cormen, C. Leiserson, & R. Rivest, Algorithms, MIT Press, 1990 1

References Texts

1) A. Aho, J. Hopcroft, & J. Ullman, The Design and Analysis of Computer Algorithms, Addison Wesley, 1974
2) Donald Knuth, The Art of Computer Programming (3 vols., various editions, 1973-81), Addison Wesley
3) The Algorithm Manual, Steven Skiena, Springer ISBN:9788184898651
4) Graphs, Networks and Algorithms, Jungnickel, Springer, ISBN: 3540219056

CS-204 Project

The Project can be platform, Language and technology independent. Project will be evaluated by project guide. Assessment will be done weekly in the respective batch. Evaluation will be on the basis of weekly progress of project work, progress report, oral, results and documentation and demonstration.

You should fill your status of the project work on the progress report and get the Signature of project guide regularly. Progress report should sharply focus how much time you have spent on specific task. (The format of progress report is given as follow.) You should keep all signed progress report. Project will not be accepted if progress report is not submitted and all responsibility remains with student.

Project Progress Report

Roll No & Name of the student	
Title of the Project	
Project guide Name	

SN	From Date	To Date	Details of Project work	Project guide sign (with date)

Head,
Deptt. of Computer Science

- You should prepare design document using SE/UML techniques depends on your project
- **Project Report Content should as foll**ow :
    1. College certificate
    2. Acknowledgement
    3. Problem Definition
    4. Existing System and need for the new system
    5. Scope of the work
    6. Feasibility study (Including H/W & S/W setup requirements)
    7. Requirement Analysis (including fact finding methods used)
    8. E-R diagrams
    9. Decision trees/Decision tables
    10. Normalized Database Design & Data Dictionary.
    11. Data flow Diagrams (if applicable)
    12. Use-case Diagrams
    13. Class Diagrams
    14. Object Diagrams
    15. Sequence Diagrams
    16. Collaboration Diagram
    17. Activity Diagram
    18. State Chart (if applicable)
    19. Component Diagram
    20. Deployment Diagram (if applicable)
    21. Use interface design

        Menus

        Input Screens using sample data

Reports, Graphs using sample data

22. Testing & Implementation plan (Should contain testing strategies, techniques used & implementation approach used.)
23. User manual
24. Drawbacks, Limitations & Proposed enhancement
25. Abbreviations used (if any)
26. Bibliography/Reference (Including book titles, authors name, editions, publications, etc)

About project Report: -

The report should be typed on A4 size, executive bond paper for the final submission. The report should be in the good quality Rexene bound. We suggest, using one-and-half spaced printing, Times New Roman 12 font sizes for the normal text, 14-16 font sizes for headings & page titles.

Number of copies:

For one project you should prepare 2 copies of the project report. One for yourself, one for college.