Sr. No. 018405

August/September 2022

B.Tech(CSE(AIML)/CE/CSE/IT) 4th Sem

Design and Analysis of Algorithms (PCC-CS-404)

Time: 3 Hours

Max. Marks:75

Instructions:

1. *It is compulsory to answer all the questions (1.5 marks each) of Part -A in short.*
2. *Answer any four questions from Part -B in detail.*
3. *Different sub-parts of a question are to be attempted adjacent to each other.*

PART -A

Q1 (a) Let f(n) and g(n) be asymptotically positive functions. Prove or disprove: f(n) = O(g(n)) implies g(n) = O(f (n)). (1.5)

(b) How to perform performance analysis of an algorithm? (1.5)

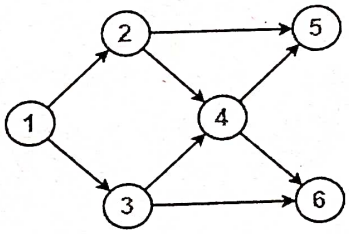
(c) What happens when the backtracking algorithm reaches a complete solution? (1.5)

(d) Describe Time and Space trade-off. (1.5)

(e) Differentiate Breadth First Search (BFS) and Depth First Search (DFS) Graph traversal Algorithms (1.5)

(f) What is the asymptotic worst-case running time for 0/1 Knapsack problem and Travelling Salesman Problem using Dynamic Programming? (1.5)

(g) Find out topological orderings of the following directed acyclic graph (Assume starting vertex 1): (1.5)



(h) List some applications of Minimum Spanning Tree (MST). (1.5)

(i) Differentiate P and NP problems. (1.5)

(j) Why randomized quick sort is more preferable to normal quicksort? (1.5)

PART -B

Q2 (a) The running time of an algorithm P1 and P2 are represented by the following recurrence relation: (10)
P1: if n <= 3 then T(n) = n else T(n) = T(n/3) + cn
P2: if n <=1 then T(n) = 1 else T(n) = T(n-1) + logn
Compute the time complexity of both the algorithms P1 and P2.

(b) Can the master method be applied to the recurrence $T(n) = 4T(n/2) + n^2 \lg n$? Why or why not? Give an asymptotic upper bound for this recurrence. (5)

Q3 (a) Consider the following instance of knapsack problem: (8)

Item	X1	X2	X3	X4	X5
Profit	15	12	9	16	17
Weight	2	5	3	4	6

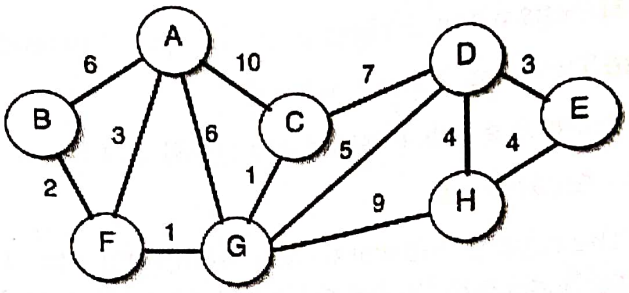
The maximum weight of 12 is allowed in the knapsack. Find the value of maximum profit with the optimal solution of the fractional knapsack problem.

(b) Write the algorithm for general iterative backtracking method and explain various factors that define the efficiency of backtracking (7)

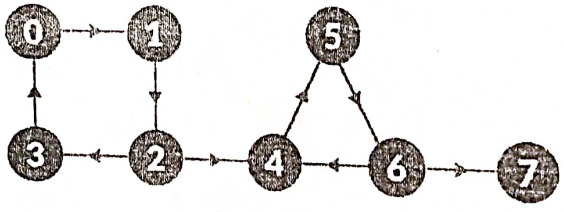
Q4 (a) Discuss greedy algorithm to generate single-source shortest path. Explain with example. Also analyze time complexity. (8)

(b) Describe the algorithm to find minimum-cost binary search tree. Show that the computing time of function OBST is $O(n^2)$ (7)

Q5 (a) Define spanning tree. Compute a minimum cost spanning tree for the given graph using prim's algorithm. Also analyze its complexity. (8)



(b) Discuss Depth First Search Algorithm for Graph Traversal. Consider the following graph and find out Strongly Connected Components in it. (7)



Q6 (a) The problem of determining whether there exists a cycle in an undirected graph is in P, NP or Both. Justify your answer. (8)

(b) Explain randomized algorithm in detail.

Q7 Write short note of the following: (7)

(a) Hamiltonian Cycle

(b) Branch and Bound Technique (15)

(c) NP-complete and NP-hard.

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