Fifth Semester B. E. (CT) (C.B.S.) Examination

DESIGN AND ANALYSIS OF ALGORITHM

Time : Three Hours] [Max. Marks : 80

N. B. : (1) All questions carry marks as indicated.

(2) Solve Six questions as follows :
Que. No. 1 OR Que. No. 2
Que. No. 3 OR Que. No. 4
Que. No. 5 OR Que. No. 6
Que. No. 7 OR Que. No. 8
Que. No. 9 OR Que. No. 10
Que. No. 11 OR Que. No. 12

(3) Due credit will be given to neatness and adequate dimensions.

(4) Illustrate the answers with necessary figures/ drawings wherever necessary.

1. (a) State and explain the Master's theorem for complexity analysis ? Also give its limitations. 6

(b) Derive a closed form solution for the summation : 7

$$S_k = \sum_{i=1}^{k-1} (i.a^i)$$

OR

2. (a) Solve the following recurrence relation with the help of characteristic equation method. 6

$$t_n = \begin{cases} 1 \text{ if } n=0 \\ 4t_{n-1} - 2^n \text{ otherwise} \end{cases}$$

(b) Solve following recurrence relation using change of variable method.

$$T(n) = 2T(\sqrt{n}) + \log n$$ 7

3. (a) State and explain in detail about various asymptotic notations which are used for analysis of algorithms. 7

(b) Illustrate the stepwise execution of quicksort on the following array A. Also give its complexity by analyzing the recurrence relation.

A = [1, 3, 5, 8, 7, 6, 4] 7

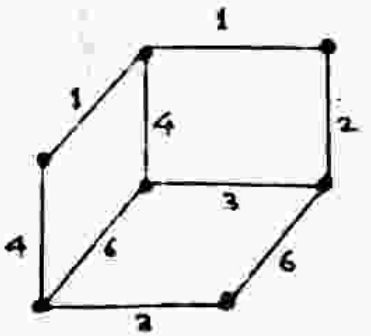
OR

4. (a) What do you mean by amortized analysis of algorithm ? Explain any one method with suitable example. 7

(b) Write an algorithm for binary search using devide and conquer strategy. Also give its stepwise execution for searching element X = 4 in following input array.

A [19, 3, 15, 8, 1, 6, 4] 7

5. (a) Find out Minimum spanning Tree with its cost for given undirected graph as follows. Use kruskal's algorithm.



6

(b) Given 8 activities along with their start and finish time as follows :

Ai	A1	A2	A3	A4	A5	A6	A7	A8
Si	1	2	3	4	8	9	11	12
Fi	5	2	4	7	11	12	13	16

Then compute a schedule where largest number of activities takes place using Greedy approach. 7

OR

6. (a) Find out optimal solution for fractional knapsack problem using Greedy strategy for following instances:

$n = 7$

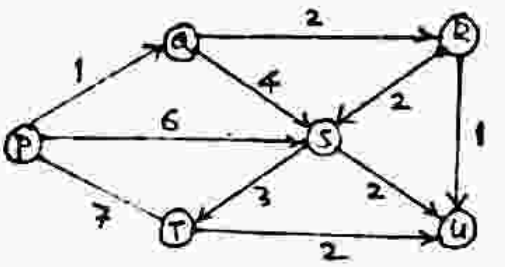
$m = 15$

$(P_1, P_2, P_3, P_4, P_5, P_6, P_7) = (10, 5, 15, 7, 6, 18, 3)$

$(W_1, W_2, W_3, W_4, W_5, W_6, W_7) = (2, 3, 5, 7, 1, 4, 1)$

6

(b) Suppose we run Dijkstra's algorithm on edge directed graph with vertex P as source on following graph. Then in what order do nodes get included into set of vertices for which shortest distances are finalized.



7

7. (a) What is principle of optimality ? Explain in brief. 4

(b) Determine the cost and structure of an optimal binary search tree for set of n = 5 keys with following searching probabilities. Illustrate answer by dynamic programming.

i	0	1	2	3	4	5
p_i	-	0.15	0.10	0.05	0.10	0.20
q_i	0.05	0.10	0.05	0.05	0.05	0.10

10

OR

8. (a) What is travelling salesman problem (TSP) ? Compute optimal TSP tour for following distance matrix using dynamic programming approach.

	A	B	C	D
A	0	10	15	20
B	5	0	9	10
C	6	13	0	12
D	8	8	9	0

7

(b) Solve the following instance of 0/1 knapsack problem using dynamic programming :

Maximize : $x_1 + 2x_2 + 5x_3$

subject to constraints :

$2x_1 + 3x_2 + 4x_3 \leq 6$

and restrictions,

$0 \leq x_i \leq 1, 1 \leq i \leq 3$ 7

9. (a) Write and explain algorithms for iterative backtracking and recursive backtracking. 5

(b) Consider $S = \{S_1, S_2, S_3, S_4\}$ and weight vector $W = \{10, 25, 5, 10\}$ and $M = 25$. Then compute all possible subsets of w that sum to m. Draw the portion of state space tree that generates a fixed length tuple using backtracking algorithm. 8

OR

10. (a) What is M-colorability optimization problem in context of graph coloring ? Explain the backtracking algorithm for graph coloring problem. 6

(b) What is Hamiltonian cycle ? Explain backtracking algorithm for it. 7

11. (a) How polynomail reduction can be used for showing NP-completeness of a problem ? 7

(b) Explain in detail about Cook's theorem. 6

OR

12. (a) What is NP-hard and NP-computer problem ? Explain in detail. 6

(b) What is clique ? Comment about its NP-completeness. 7