

DESIGN AND ANALYSIS OF ALGORITHMS

Paper-PC-CS-AIDS-303 A

Time : Three Hours]

[Maximum Marks : 75

Note : Attempt any five questions.

1. Answer following questions in brief. Each part is of 3 marks.

(a) What is priority queue? Explain with the help of example.

(b) Write the master theorem for solving recurrence relation.

(c) What is topological sort? Show with example.

(d) What is merging network? Illustrate with example.

(e) Define Binomial heap with example. (3×5=15)

2. (a) Explain Big-oh, Big-omega and Big-theta notations of the complexity. Also show each with the help of example and graph. (7)

(b) What is task scheduling problem? Compute the optimal sequence of task for following deadlines. (8)

Task	Deadlines	Profit
T ₁	8	21
T ₂	2	23
T ₃	3	11
T ₄	5	9
T ₅	7	5
T ₆	1	17
T ₇	4	28
T ₈	6	14
T ₉	2	33

3. (a) Explain Strassen's matrix multiplication algorithm and compute the matrix multiplication of following using Strassen's algorithm.

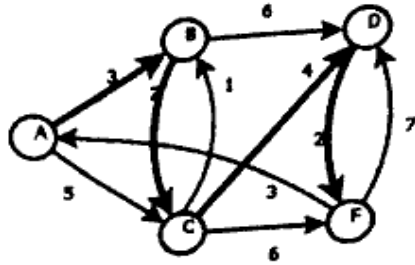
$$X = \begin{bmatrix} 3 & 2 \\ 4 & 8 \end{bmatrix} \quad Y = \begin{bmatrix} 1 & 5 \\ 9 & 6 \end{bmatrix} \quad (7)$$

(b) Define Fibonacci heap. Write the pseudo code for insertion and union operation in the Fibonacci heap. (8)

4. (a) What is the minimum spanning tree? Explain the Kruskal's Algorithm to find the minimum cost spanning tree with its steps. (7)

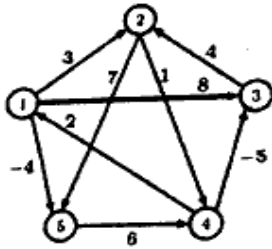
(b) Write the properties of red-black tree. Explain the insertion and deletion operation of red-black tree in detail. (8)

5. (a) Explain Dijkstra's algorithm for single source shortest path. Find shortest path from vertex A to each other vertex using Dijkstra's algorithm. (8)



- (b) Explain the following terms with example: class P, class NP, NP hard problem. Also draw the overlapping sets of P, NP, NP hard, and NP complete. (7)

6. (a) Explain Bitonic sorting network with example. (7)
- (b) Explain Floyd-Warshall Algorithm to find all pair shortest path. Find all pair shortest path of following problem also analyze its complexity. (8)



7. (a) Explain breadth first search algorithm for graph traversal and write its pseudo code. Also analyze its time complexity. (8)

- (b) Explain Quick sort algorithm with example. Also write pseudo code and analyze its complexity. (7)

8. (a) What is greedy algorithm? Explain travelling salesman problem using greedy approach. Write its basic steps. (8)

- (b) Solve following recurrence relation using substitution method. (7)

$$T(n) = \begin{cases} 1 & \text{if } n = 1 \\ 2T\left(\frac{n}{2}\right) + \theta(n) & \text{if } n > 1. \end{cases}$$