[ET] Enroll. No. -

END SEMESTER EXAMINATION : NOVEMBER - 2022

106

ANALYSIS AND DESIGN OF ALGORITHMS

Time :03 Hrs. Maximum Marks :60

Note: Attempt questions from all sections as directed. **[24 Marks]**

Section - A : Attempt any Four questions out of Five . Each question carries 06 marks.

Q1. Indicate, for each pair of expressions (A,B) in the table below, whether A is O, Ω and θ of B. Assume that $k \geq 1$, $\varepsilon > 0$, and $c > 1$ are constants. Your answer should be in the form of the table with "yes" or "no" written in each box.

A	B	O	Ω	θ
2logn	nn			
nlogc	clogn			
2n+5	22n			
n2logn	n(logn)10			

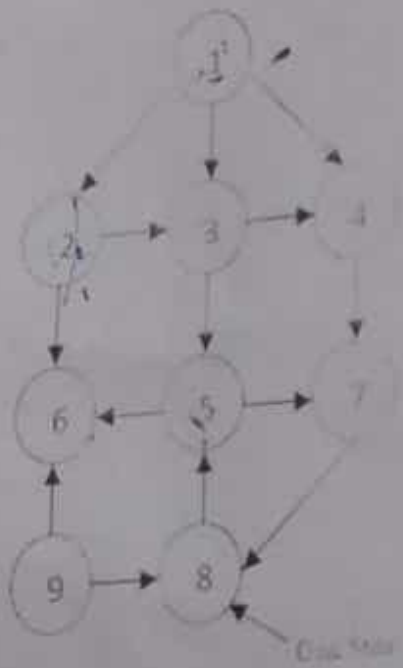
Q2. Explain how the Strassen matrix multiplication method is used to multiplies two matrices A and B, each of the dimensions (nxn) in $O(n^{\log 7})$.

Q3. Write an algorithm to solve the fractional knapsack problem. Consider the following instance of the fractional knapsack problem: Number of objects (n)=6 Capacity of Knapsack (M)=100

items:	A	B	C	D	E	F
Profits:	40	35	20	4	10	6
Weights:	100	50	40	20	10	10

Find the value of optimal solution and solution vector X={x1,x2,x3,x4,x5,x6}.

Q4. Differentiate between Depth-first search (DFS) and Breath-First search (BFS) with respect to time and space complexity. Find the BFS sequence for the following graph?



Q5. Differentiate between P, NP, NP-Complete and NP-Hard problems with a suitable diagram. Let L be an NP-complete problem and Q and R be two other problems not known to be in NP. Q is polynomial time reducible to L and L is polynomial-time reducible to R. What you can say about problem R? [20 Marks]

Section – B : Attempt any two questions out of three. Each question carries 10marks.

Q6. **(a)** Differentiate between Kruskal's and Prim's algorithm to find the minimum cost spanning tree (MCST). Consider a weighted complete graph G of N vertex set V={V1,V2,..... VN) such that the weight of the edge is 2|i-j|. Find the MCST of G (that is a general formula for G in terms of N) using Prim's Algorithm. (5)

(b) Find the Longest common subsequence (LCS) of the following two sequence X and Y, where X=bccabcc and Y=bcacbcab (5)

Q7. **(a)** Give an asymptotic tight solution to the following recurrence

(i) $T(n) = \begin{cases} 1 & n = 1 \\ 2T\left(\sqrt{n}\right) + \log n & n \geq 2 \end{cases}$ (5)

(ii) $T(n) = 4T\left(\frac{n}{2}\right) + \frac{n^2}{log^4 n}$ (5)

(b) Write an algorithm to solve N Queen's problem using backtracking. Write one solution for 8-Queen's problem. (5)

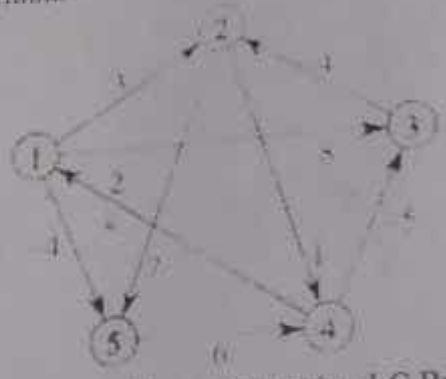
Q8 **(a)** Prove that the CLIQUE problem is NP-Complete. (5)

(b) Consider the 5 matrices: M1, M2, M3, M4 and M5 with dimensions (4x10), (10x3), (3x12), (12x20) and (20x7).Find the optimal way (minimum cost) of multiplying these chain of matrices using dynamic programming (5)

[16 Marks]

Section - C : Compulsory question

Q9 **(a)** Find the shortest distances between every pair of vertices in a given edge-weighted directed Graph, using the Floyd algorithm. (8)



(b) Solve the following travelling salesman problem (TSP) using LC Branch and Bound, where the cost matrix C[i,j] of the graph G, having 5 vertices are given as follows: (8)

$$C[i,j] = \begin{bmatrix} \infty & 20 & 30 & 10 & 11 \\ 15 & \infty & 16 & 4 & 2 \\ 3 & 5 & \infty & 2 & 4 \\ 19 & 6 & 18 & \infty & 3 \\ 16 & 4 & 7 & 16 & \infty \end{bmatrix}$$

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