

Subject Code: CSE303

Enrollment No.....

MID TERM EXAMINATION-September 2023

Analysis and Design of Algorithm

Time: 01Hr

Maximum marks: 30

Note: Attempt questions as per Instructions

SECTION-A (Attempt Any Two questions out of three, Each of 05 Marks)

Q.1 Indicate, for each pair of expressions (A,B) in the table below, whether A is O , Ω , Θ , o , or ω of B. Your answer should be in the form of the table with "yes" or "no" written in each box.

	A	B	O	Ω	Θ	o	ω
a.	$n^2 \log n$	$n(\log n)^{10}$					
b.	$3n^{\sqrt{n}}$	$2^{\sqrt{n}} \log n$					
c.	$(\log n)^{\log n}$	$(n)^{\frac{1}{\log n}}$					

Q.2 Consider a weighted complete graph G of 5 vertex set $\{V_1, V_2, V_3, V_4, V_5\}$ such that the weight of the edge (V_i, V_j) is $2|i - j|$. Find a minimum cost spanning tree (MCST) of G using Prim's Algorithm. Find the generalized formula for MCST for the same complete graph G having n vertices $\{V_1, V_2, \dots, V_n\}$.

Q.3 Find the optimal solution of the following instance of knapsack problem (fractional):

Number of objects $n=7$, Capacity of Knapsack $(M)=14$

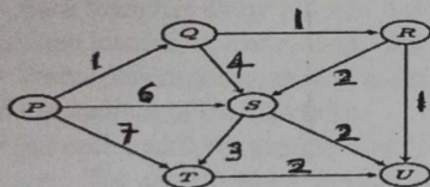
Items (I_i)	I_1	I_2	I_3	I_4	I_5	I_6	I_7
Profits (p_i)	4	9	7	8	15	5	10
Weights (w_i)	2	3	4	1	5	1	3

SECTION-B (Attempt Any One question, out of two, Each of 10 Marks)

Q.4.(a) Write a $PARTITION(A, p, r)$ algorithm of Quicksort which partition the given input array $A[p, \dots, r]$ to set pivot element (say $A[r]$). Find its time complexity also.

(b) Explain how V. Strassen's matrix multiplication method is used to multiply 2 matrices of size $(n \times n)$ in less than $O(n^3)$ time. Consider 2 matrices A and B of size (16×16) . Find the total number of multiplications for multiplying A and B using V. Strassen's method.

Q.5 Apply Dijkstra's algorithm on the following graph G to find shortest path from vertex $[P]$ to other vertices of G . Step by step calculate *shortest path estimate* of $d[]$ value for each vertex of G and order of vertices gets included in set S .



SECTION-C (Compulsory, 10 Marks)

Q.6(a) Solve the following recurrences:

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

(ii) $T(n) = \sqrt{n}T(\sqrt{n}) + n$

[6+4=10]

(b) Write the recurrence relation and time complexity of the problem listed below

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S. No.	Problem	Recurrence relation (Worst Case)	Time complexity
1	Binary search		
2	V. Strassen's Matrix multiplication		
3	Quicksort		
4	Suppose the running time of Module A is taking constant time M. Find the time complexity of the following procedure. <pre>1. Repeat for I = 1 to N 2. Repeat for J = 1 to I 3. Repeat for K = 1 to J 4. Module A 5. (End of Step 3 loop.) 6. (End of Step 2 loop.) 7. (End of Step 1 loop.) 8. Exit</pre>		