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**MIT WORLD PEACE
UNIVERSITY**

TECHNOLOGY, RESEARCH, SOCIAL INNOVATION & PARTNERSHIPS

School of Computer science and Engineering

Department of Computer Engineering and Technology

SY BTech (CSE/AIDS) (Academic Year 2024-25)

Mid Term Exam – Semester IV

Course Name:- Design and Analysis of Algorithms

Course Code:-CSE2PM09A/AID2PM07A

Maximum Marks: 30

Time: 1 Hr. 00 Minutes

Date:

Instructions:-

1. Attempt any 3 questions from Q. 1 to Q. 4 AND
Attempt any 3 questions from Q. 5 to Q. 8
2. Figure to the right indicates full marks.
3. Use of cell phone is prohibited in the examination hall.
4. Neat diagrams must be drawn wherever necessary.
5. Assume suitable data, if necessary and clearly state.
6. Use of scientific calculator is allowed

Attempt any 3 questions from Q. 1 to Q. 4

Q.1	CO1 Remembering	Solve following recurrence using substitution method: $T(n) = T(n/3) + C$, $T(1) = 1$	[5 Marks]
Q.2	CO1 Understanding	Write a pseudo code for Linear Search. Give one example and analyze the time complexity.	[5 Marks]
Q.3	CO2 Applying	After a natural disaster, relief trucks need to deliver supplies to affected areas. Each truck has a weight capacity, and different supplies (water, food, blankets and medicines) have different values and weights. To maximize the total value of supplies delivered, you can take fractional quantities of each item. Find an optimal solution to this instance. Input: Truck Capacity = 50 kg Supplies (Weight, Value): Water: 20 kg, \$100 Food: 30 kg, \$120 Blankets: 10 kg, \$200 Medicines : 3kg, \$10	[5 Marks]

Q.4	CO2 Understanding	Write a pseudo code for Merge sort and analyze its time complexity.	[5 Marks]
Attempt any 3 questions from Q. 5 to Q. 8			
Q.5	CO2 Applying	Construct an AVL search tree by inserting the following elements in the order of their occurrence. Show the balance factor and type of rotation at each stage: M, T, O, Q, S, R, W, V, Y, U, C, G, E, X	[5 Marks]
Q.6	CO2 Design, Applying	A software project has multiple modules. Some modules depend on others being built first. Determine all possible correct build order for the following modules. (Hint: Use Topological Sorting to determine the order in which modules should be built.) Modules: {UI, Database, Backend, API, Authentication} Dependencies: <ul style="list-style-type: none">• Database must be built before Backend.• Backend must be built before API.• API must be built before UI.• Authentication must be built before API.	[5 Marks]
Q.7	CO1 Understanding	Define O (Big-oh) notation and prove that if $T(n) = 15n^3 + n^2 + 4$, $T(n) = O(n^3)$.	[5 Marks]
Q.8	CO2 Remembering	Differentiate between Divide & Conquer and Greedy method. Give one example of each.	[5 Marks]



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Term End Examination

May/June 2025

CSE2PM09A/AID2PM07A - Design and Analysis of Algorithms

Question Paper ID: 056624

Faculty/School	School of Computer Science and Engineering	Term	Semester IV
Program	SY B.Tech CSE/AIDS	Duration	1 hour 30 minutes
Specialization	-	Max. Marks	40

Section - 1 (8 X 5 Marks)

Answer any 8 questions

1	Write a pseudo code for recursive Binary Search and discuss its complexity.	5 marks	CO1	Understanding
2	Let the number of jobs be 5 and the associated profits with these jobs be p1=20, p2=60, p3=40, p4= 100 and p5= 80 respectively. The deadline for completion of these jobs are d1= 2, d2=2 , d3=1 , d4=3 and d5=4 respectively for the 5 jobs. Find the feasible solutions and an optimal solution for these job sequencing using Greedy approach?	5 marks	CO2	Applying
3	A delivery person needs to drop off packages at 4 locations, starting and ending at the home base (Location 0). The time (in minutes) to travel between each pair of locations is given below:	5 marks	CO3	Applying

From / To	0 (Office)	1 (Hub A)	2 (Hub B)	3 (Hub C)
0	0	10	15	20
1	10	0	35	25
2	15	35	0	30
3	20	25	30	0

The delivery person must visit all locations exactly once and return to the starting point (Location 0), minimizing the total travel time.

Using dynamic programming, calculate the minimum total travel time to complete the route. Consider 0 as the source vertex.

$$\begin{array}{c}
 50 + 15 = 65 \\
 65 + 30 = 95 \\
 95 + 20 = 115 \\
 115 + 10 = 125 \\
 125 + 0 = 125
 \end{array}$$

$$\begin{array}{c}
 70 + 10 = 80 \\
 80 + 15 = 95 \\
 95 + 20 = 115 \\
 115 + 0 = 115
 \end{array}$$

$$\begin{array}{c}
 65 + 25 = 90 \\
 90 + 30 = 120 \\
 120 + 0 = 120
 \end{array}$$

4	<p>Two employees are editing the same document over time. One version of the document is saved as:</p> <ul style="list-style-type: none"> Version X: "ABCDEF" <p>Another employee made edits resulting in:</p> <ul style="list-style-type: none"> Version Y: "AEBDF" <p>As a version control analyst, your task is to find the longest common sequence of edits or content that appears in both versions, in the same order (but not necessarily contiguous).</p> <p>Using the Longest Common Subsequence (LCS) algorithm, identify the common sequence of characters present in both versions.</p>	5 marks	CO3	Applying
5	<p>What is the maximum profit for the below 0/1 knapsack problem using branch and bound, also draw the state space tree for the same ? weights = (1, 2, 3), values = (60, 100, 120), m = 5.</p>	5 marks	CO4	Applying
6	<p>A food truck company wants to plan a circular delivery route that starts and ends at their base (Node a), visiting each of their delivery stops exactly once before returning.</p> <p>The delivery points are connected by roads, and the availability of direct routes is represented in the graph above. Also, draw the state space tree that illustrates the backtracking process to explore all possible paths. Using the backtracking method, determine whether there exists a Hamiltonian cycle — a closed loop that visits every node exactly once and returns to the starting point.</p>	5 marks	CO4	Applying
7	<p>Explain in detail Control Abstraction of Least Cost (LC) Search</p>	5 marks	CO4	Understanding
8	<p>A library assigns unique IDs to books for tracking their location and availability. Design a hash table to store book information (e.g., title, author). Use the division method $h(k)=k \bmod m$ where $m=7$ Insert book IDs {12345, 67890, 54321, 98765, 11111}. Resolve collisions using quadratic probing</p>	5 marks	CO1	Applying

9	Write a pseudo code to insert key in to hash table using linear probing without replacement	5 marks	CO1	Understanding
10	Differentiate between NP complete and NP Hard.	5 marks	CO5	Remembering

END OF QUESTION PAPER

722.76.146.37 (MIT WPU)
 $C = \sum_{i=0}^{m-1} h(i)$
 linear probing
 $h(i) = (h(x) + i) \% m$