

JK Lakshmipat University Jaipur
INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination, April 2024

B. Tech. in Computer Science Engineering, Semester-IV

Roll No.....

Course Code: CS1105

Time: 2 hour 30 Minutes**Max. Marks: 30**

Course Name: Design and Analysis of Algorithms

Instructions to students:

1. Do not write anything other than your roll number on question paper.
2. Assume suitable data wherever required and mention it clearly.
3. All Questions are compulsory and write a line explaining your answer.

Q1.	a) Solve the following recurrence relation using Master's theorem- $T(n) = \sqrt{2}T(n/2) + 10$ b) Write the recurrence relation for searching an element in a sorted array of size n using modified binary search where instead of a middle matching point, matching points are kept at $n/4$, $n/2$ and $3n/4$.	02 Marks
Q2.	a) Write an efficient algorithm to search a number in an m x n integer matrix. The matrix has the following properties: 1.Integers in each row are sorted in ascending from left to right. 2.Integers in each column are sorted in ascending from top to bottom. Complexity of normal search would be $O(m \times n)$. You have to design an algorithm better than this – assuming $n < m$. b) Suppose you have been given a set of n coins and you are told that at most one of the n coins is lighter than others. Your task is to develop an efficient test procedure to determine which coin is defective or report that none is defective. To do the test, you have a scale which indicates whether left side is heavier or right side is heavier if you put some coins on left side and some coins on right side. Write the test algorithm clearly and calculate the complexity of the algorithm.	03 Marks
		CO 3

Q3.	(a) For the keys given below, how many comparisons would be performed to search the key 25 if the data is stored in a multiway search tree of order 4. Keys are: 30, 10, 45, 78, 67, 34, 90, 100, 12, 25 (b) For the keys given above, how many comparisons will be performed if the data is stored in a B-tree of order 5 to search the key 25.	02 Marks 02 Marks CO 2 CO 3
Q4.	a) Consider the matrices P, Q and R with dimensions -10 x 20, 20 x 30 and 30 x 40 respectively and assume, we want to multiply them. Using Dynamic programming, find the optimal parenthesization so that the number of multiplications are minimum. Show the steps and evaluate how many multiplications would be required.	03 Marks CO 5
Q5.	a) Using Bellman-Ford Algorithm, find the shortest distance from source vertex 'P' to the all vertices. in the following graph- Show the steps. <pre> graph LR P((P)) -- 2 --> Q((Q)) P((P)) -- -1 --> R((R)) Q((Q)) -- -1 --> S((S)) Q((Q)) -- 2 --> R((R)) R((R)) -- 1 --> S((S)) R((R)) -- 3 --> T((T)) S((S)) -- 2 --> T((T)) </pre> b) For the above graph if we apply Dijkstra Algorithm find the path from source to all vertices. Explain why the results are different?	04 Marks 02 Marks CO 4 CO 5
Q6.	a) Given a graph $G = (V, E)$ represented as an adjacency matrix. Write a program in C to find the components in the graph by using Union Find data structure. You can assume there are maximum 10 vertices. Or Apply 2-approximate polynomial time approximation algorithm to solve the TSP problem for the complete graph $G = (V, E)$ taking root node as 'a', where $V = \{a, b, c, d, e\}$ and the cost of each edge is as follows: $ab = 3, ac = 4, ad = 4, ae = 3, bc = 2, bd = 4, be = 2, cd = 3, ce = 3, de = 2$	04 Marks CO 5 CO 6
Q7.	Write the problem statement of following problems and explain why they are called unsolvable problems. 1. Satisfiability Problem 2. Vertex Cover Problem	04 Marks CO 6 CO 7

*****BEST OF LUCK*****