STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI – 600 086
(For candidates admitted from the academic year 2023 – 2024)

M.Sc. DEGREE EXAMINATION, APRIL 2024
INFORMATION TECHNOLOGY
SECOND SEMESTER

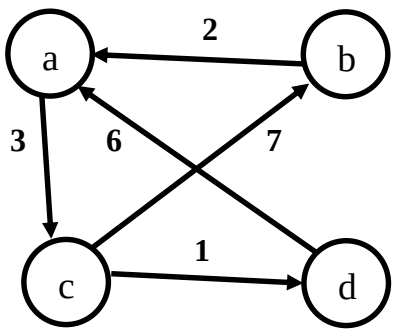
COURSE : MAJOR CORE
PAPER : DESIGN AND ANALYSIS OF ALGORITHMS
SUBJECT CODE: 23CS/PC/AA24
TIME : 3 HOURS **MAX. MARKS: 100**

Q. No.	SECTION A Answer all the questions. (10 x 2=20)	CO	KL
1.	Define: Data Structure.	CO1	K1
2.	What are Abstract Data Types?	CO1	K1
3.	Give any two applications of Stack.	CO1	K1
4.	Briefly mention the Knapsack problem.	CO1	K1
5.	Define NP-hard and NP-complete problems.	CO1	K1
6.	Define: Algorithm.	CO1	K2
7.	List the types of design techniques of an algorithm.	CO1	K2
8.	What is the time complexity of bubble sort?	CO1	K2
9.	When is a queue said to be circular?	CO1	K2
10.	What is Greedy technique?	CO1	K2
Q. No.	**SECTION B** **Answer all the questions (4 x 5=20)**	**CO**	**KL**
11.	a) List and explain the operations that can be performed on queues. **(OR)** b) What are the diffrent traversals that can be performed on Binary trees? Explain anyone.	CO2	K3
12.	a) Write an algorithm for insertion operation in a doubly linked list. **(OR)** b) Explain the traveling salesman problem with a suitable example.	CO2	K3

<table>
<tr><td>13.</td><td>a) Simulate the Bubble sort algorithm to sort the list
S, T, E, L, L, A
in alphabetical order.
(OR)
b) Apply the Hungarian Method to the following Assignment Problem in which each programmer is assigned to only one project. The cost of assignment is given in the following table:

<table><tr><td></td><td>Project 1</td><td>Project 2</td><td>Project 3</td></tr><tr><td>Programmer 1</td><td>9</td><td>2</td><td>7</td></tr><tr><td>Programmer 2</td><td>6</td><td>4</td><td>3</td></tr><tr><td>Programmer 3</td><td>5</td><td>8</td><td>1</td></tr></table>
The objective of the problem is to minimize the total assignment cost.</td><td>CO2</td><td>K3</td></tr>
<tr><td>14.</td><td>a) How are the best-case and worst-case time complexities estimated for algorithms?
(OR)
b) Write the algorithm for Binary search. What is its time complexity?</td><td>CO3</td><td>K4</td></tr>
<tr><td>Q. No.</td><td>SECTION C
Answer all the questions (6 x 10=60)</td><td>CO</td><td>KL</td></tr>
<tr><td>15</td><td>a) With suitable examples explain Depth-First Search algorithm and Breadth-First Search algorithm.
(OR)
b) Given 5 coins out of which one coin is lighter. In the worst case, how many minimum number of weighing are required to find the fake coin, given a weighing balance?</td><td>CO2</td><td>K3</td></tr>
<tr><td>16</td><td>a) Write and explain the quicksort algorithm. What are its best, average and worst-case time complexities?
(OR)
b) What is Divide and Conquer technique? Explain how it is used in Strassen’s matrix multiplication.</td><td>CO3</td><td>K4</td></tr>
<tr><td>17</td><td>a) Write the algorithm for solving the 8 Queens problem by applying the Backtracking Technique.

(OR)
b) Given the following weighted connected directed graph, apply the Floyd’s algorithm to find the All-Pairs Shortest-Path.

 
</td><td>CO3</td><td>K4</td></tr>
</table>

18	a) Discuss and analyze how the Knapsack Problem is solved using Dynamic Programming and Branch and Bound Technique. **(OR)** b) Write and explain the Merge sort algorithm and discuss about the best, average and worst case scenarios.	CO4	K5
19	a) Compare and Contrast the Prim's Algorithm and Kruskal's Algorithm for finding the Minimum Spanning Tree for a given graph. **(OR)** b) Write and explain the Dijkstra's Algorithm for Single-Source Shortest-Path Problem.	CO4	K5
20	a) Design an algorithm for the change-making problem given an amount n and unlimited quantities of coins of each of the denominations d_1, d_2, …. , d_m, find the smallest number of coins that add up to n or indicate that the problem does not have a solution. **(OR)** b) Write recursive and non-recursive algorithms to print the first 10 Fibonacci numbers and analyze the algorithms for space and time complexity.	CO5	K6

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