No of Pages : 3 Course Code : 20MX22

Roll No:
(To be filled in by the candidate)

PSG COLLEGE OF TECHNOLOGY, COIMBATORE 641 004

SEMESTER EXAMINATIONS, JUNE 2023

MCA Semester : 2

20MX22 DESIGN AND ANALYSIS OF ALGORITHMS

Time : 3 Hours **Maximum Marks : 100**

INSTRUCTIONS:

1. Answer **ALL** questions. Each question carries 25 Marks.
2. Course Outcome : Table

Qn.1	CO1	Qn.2	CO2	Qn.3	CO3	Qn.4	CO4

1. a) Define Big O notation. What is the functionality of the following code?

```
Algorithm BS ([ ], Left, Right, KEY) {
1. if (Left > Right)
       return (−1);
2. m = ⌊(Left + Right) /2 ⌋
3. if (KEY == A[m])
       return (m);
   else if (KEY < A[m])
       return (BS(A, Left, m − 1, KEY));
   else return (BS(A, m + 1, Right,KEY)); }
```

Write the recurrence relation describing the function? Solve the recurrence relation and find the complexity of the algorithm. (5)

b) Illustrate heap sort and radix sort with the following numbers. 45, 65, 78, 90, 23, 30, 10, 50. Show the result of the intermediate passes. What is the complexity of these algorithms? (8)

c) Formulate Quick sort algorithm. Trace the algorithm on the elements 45, 65, 78, 90, 23, 30, 10, 50. Write the recurrence relations corresponding to best and worst case of Quick sort. What is the best case and worst case complexity of quick sort? (12)

2. a) What are tries? Describe insertion, deletion and search operations on tries. Create a trie with the following elements: find, fox, fish, fire, cat, cash, cap, set, sap. Delete elements set, cap and fish. Show the resultant trie. (5)

b) What is a Binary Search Tree (BST)? Create a BST with the elements 10, 20, 30, 40, 50, 60, 70. What is the worst case complexity of search operation in this case? How can you improve the search operation in this case? Show the tree corresponding to the best case. What is the best case complexity? Write algorithm for insertion of an element. Write the steps for deletion of element from a BST (8)

c) i) What is an AVL tree? What is the advantage of AVL tree over Binary Search Tree? Describe the various types of rotations used to balance the tree. Write the steps involved in insertion and deletion of elements in AVL tree. Draw all the rotations that you must perform and the final AVL tree after the following elements are inserted in the given order starting from an empty tree. 1, 10, 5, 7, 3, 13, 6, 4, 8, 9. (12)

(OR)

ii) What is a B Tree of order m? Create a B Tree of order 5 with the following elements: 1,7, 6, 2, 11, 4, 8, 13, 10, 5, 19, 9, 18, 24, 3, 12, 14, 20, 21, 16. Delete 5, 6 and 13. Show the tree when the number of nodes either increase or decrease and the final resultant tree.

3. a) Compare the way a problem is solved using divide and conquer method and dynamic programming. For each of the methods, give example of a problem that can be solved and a problem that cannot be solved using the method. (5)

b) State Principal of Optimality. Show that it can be applied for finding the shortest path between every pair of vertices in a graph. Using the principles, find the shortest path between all pairs of vertices in the graph shown in Fig. 1. (8)

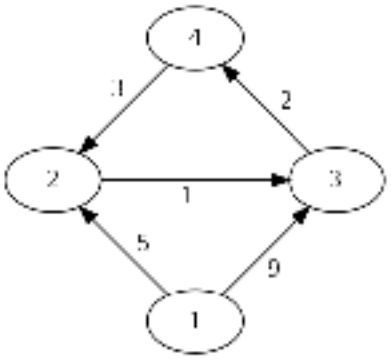

Fig.1

c) i) State multi stage graph problem. Explain the algorithm design technique used for solving the problem. Using the principles solve the problem described in Fig. 2 (12)

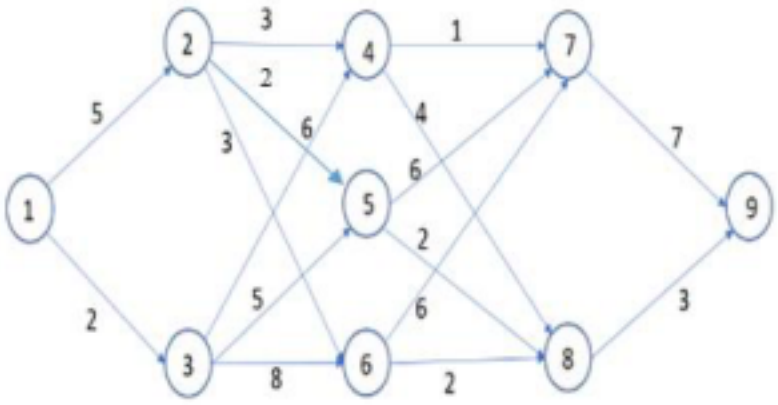

Fig.2

(OR)

ii) Explain the general principles of Divide and Conquer method of algorithm design. Formulate merge sort algorithm based on divide and conquer principles. Illustrate with an example. Write the recurrence relation and find the complexity of the algorithm.

4. a) Find Huffman coding for the following characters.

Character	Frequency
A	32
B	28
C	12
D	15
E	53
F	13
X	3
Y	11

Illustrate decoding of message with an example. (5)

b) i) Draw the state space tree corresponding to 4 queens problem. Mark the different types of nodes in the tree. Highlight the difference between backtracking and branch and bound method. (4)

ii) Choose the colour of the districts of the map shown in Fig 3 with minimum number of colours. Explain the algorithm design technique that can be used to solve the problem. Illustrate the steps. (4)

Fig. 3

c) What is a minimum spanning tree? Formulate Prim's algorithm to find the Minimum spanning tree of a graph. Using Prim's algorithm starting with vertex "A", list the vertices of the graph shown in Fig. 4 in the order they are added to the minimum spanning tree (12)

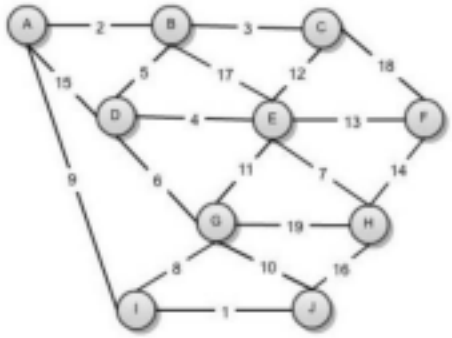

Fig.4

/END/

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