No of Pages : 3 **Course Code : 18XW34**

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

PSG COLLEGE OF TECHNOLOGY, COIMBATORE - 641 004

SEMESTER EXAMINATIONS, NOVEMBER 2019

MSc - SOFTWARE SYSTEMS Semester : 3

18XW34 DESIGN AND ANALYSIS OF ALGORITHMS

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

INSTRUCTIONS:

1. Answer **ALL** questions. Each question carries 20 Marks.
2. Subdivision (a) carries 3 marks each, subdivision (b) carries 7 marks each and subdivision (c) carries 10 marks each.
3. Course Outcome : Table

Qn.1	CO1.	Qn.2	CO2.	Qn.3	CO.3	Qn.4	CO4	Qn.5	CO5

1. a) Analyze the time complexity of the following code snippet

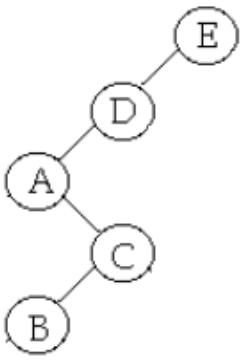
```
for i=1 to n
    for j=1 to m step j=j/2
        print a[i][j]
```

b) i) For the given pair of function find whether f(n) is O(g(n)), $\Omega(g(n))$ or $\Theta(g(n))$ where f(n)=logn and g(n)=n. (3)

ii) Prove that the maximum height of an AVL tree is O(logn). (4)

c) Define AVL trees. Starting from an empty tree construct an AVL tree for the following keys 99, 12, 19, 38, 74, 67, 89, 90, 1, 12, 16, 28, 34. From the constructed tree delete the keys 67, 12, 19 and 34 successively from the tree.

2. a) Consider the given splay tree. Find ranks for all the nodes in the tree. Splay the node B and find the rank of the nodes after the splay step.

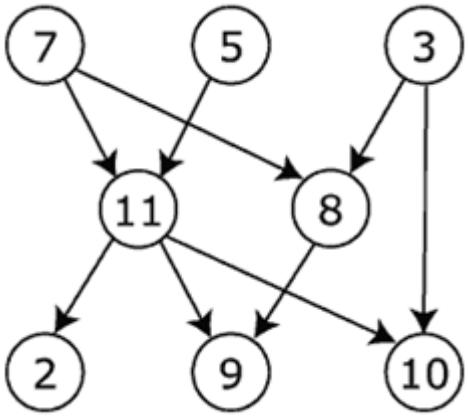


b) i) What is the maximum and minimum height of a B-tree with 364 keys with order 4? (3)

ii) Prove that the amortized cost of splaying the tree for zig-zig or zag-zag operation is 3(r'(x) –r(x)) where r'(x) and r(x) are the ranks of the node before and after the splay step. (4)

c) Starting from an initial empty tree, Construct B-tree for the following keys 39, 25, 62, 34, 56, 81. 23, 90, 20, 44, 51, 62, 40, 88, 93, 14, 105, 110 with order 4. Delete the keys 81, 56 and 62 successively from the tree.

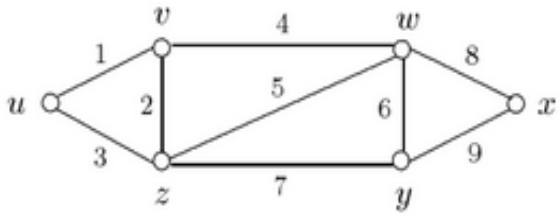
3. a) Find Topological ordering for the following graph.



b) i) What is the improvement given by Strassens to multiply two matrices? How? (3)

ii) Brief the Strassen's matrix multiplication algorithm. Why the algorithm stops at n=1 where n is the size of the matrix? (4)

c) What is the use of Find() and Union() in Kruskal's minimum spanning tree? Find the minimum spanning tree in the following graph using Kruskal's algorithm and give the proof of correctness.



4. a) Using backtracking technique find the subset of items to result in a sum of 13 with elements {3, 4, 5, 6}

b) i) What is the condition to check that no two queens attack each other? Why? (3)

ii) Write the algorithm to place n-queens on the checker board using backtracking. Illustrate backtracking to place four queen on the checker board (4)

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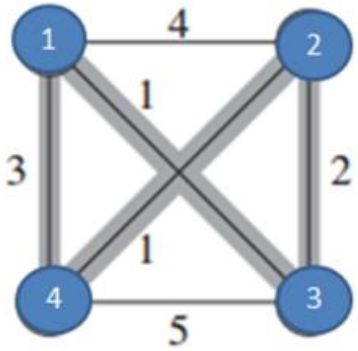
c) Provide the recurrence relation to solve travelling salesman problem using dynamic programming and state the base condition. Using the relation solve the given travelling salesman problem using dynamic programming technique



5. a) Define the complexity classes NP, NP-complete and NP-hard.

b) i) Which of the following statements are TRUE? Why? (3)

(1) To prove a problem Y is NP-hard is to take a well known problem Z which is NP hard and reduce Z to Y.

(2) A problem Y is NP hard then it is NP complete.

(3) If a problem Y in NP can be solved deterministically in polynomial time, then P=NP

ii) What is the bounding function for solving travelling salesman problem? How is it calculated? (4)

c) Explain the branch and bound procedure for solving 0/1 knapsack problem. Solve the given 0/1 knapsack problem and find the items that are to be included to maximize the profit where w={4, 7, 5, 3} p={40, 42, 25, 12} W=10.

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