Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Sixth Semester B.Tech Degree Supplementary Examination May 2023 (2019 Scheme)

Course Code: CST306

Course Name: ALGORITHM ANALYSIS AND DESIGN

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries 3 marks. Marks

1 Let $f(n) = 7n + 4$.Prove that this is of the order of $\Omega(n)$. (3)

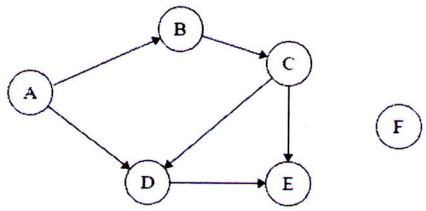
2 Solve the following recurrence using Master theorem. (3)

a) $T(n) = 8T\left(\frac{n}{2}\right) + n^2$

b) $T(n) = 2T\left(\frac{n}{2}\right) + n$

3 Define MAKE_SET(x), UNION(x,y) and FIND_SET(x) operations of disjoint set data structure with a suitable example. (3)

4 Find any ONE topological ordering of the following the graph (3)



5 Give the control abstraction of Divide and Conquer algorithm design strategy. (3)

6 Apply greedy algorithm for fractional knapsack to find the optimal ordering for loading the items in the knapsack. Let the knapsack capacity, M=15 (3)

Items	Weight	Profit
1	8	24
2	9	18
3	5	20

7 Explain about the structure of an optimal paranthesization of matrix-chain multiplication problem. (3)

8 Distinguish the branch-and-bound technique from the backtracking technique. (3)

9 Discuss the need for approximation algorithm. (3)

10 Define graph colouring problem. (3)

PART B

Answer one full question from each module, each carries 14 marks.

Module I

11 a) Define the asymptotic notations: Big Oh, Big Omega, Theta, little oh and little omega. (6)

b) Solve the following recurrence using recursion tree method: (8)

1) $T(n) = T\left(\frac{n}{2}\right) + 1, T(1) = 1$

2) $T(n) = 2T\left(\frac{n}{2}\right) + n^2, T(1) = 1$

OR

12 a) Perform complexity analysis for the following code segments: (6)

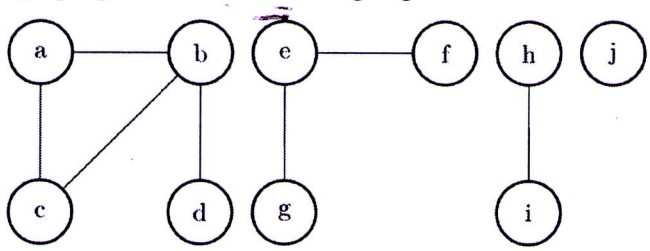
1)
```
For i=1 to n do
    For j = 1 to n do
        A=B * C
    End for
End for
```

2)
```
Function F(n)
{
    If(n==0)
        return(1)
    Else
        return (n*F(n-1))
}
```

b) Discuss the concept of best case, worst case and average case complexity of an algorithm with linear search algorithm. (8)

Module II

13 a) What are the operations supported by Disjoint Data Structure? Explain the working of Disjoint Set Data Structure for computing Connected Components of an undirected graph given in the following Figure. (7)



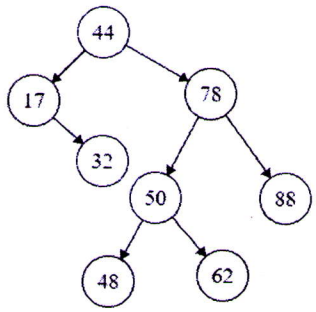
b) Illustrate the advantage of AVL trees with a suitable example. Discuss the various rotations required to balance the height of AVL tree during insertion and deletion. (7)

OR

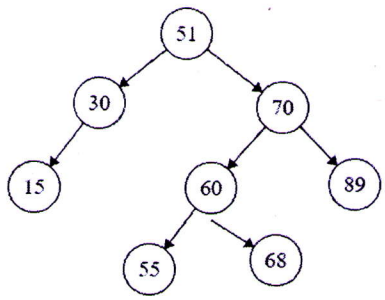
14 a) Give BFS algorithm for graph traversal and perform its complexity analysis. (7)

b) Perform the following operations in the given AVL trees. (7)

1) Insert 54 in Tree 1



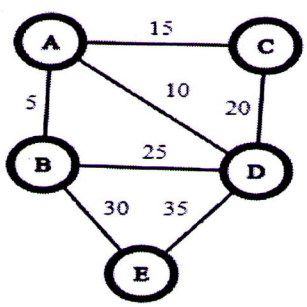
2) Delete 15 from Tree 2.



Module III

15 a) Write a divide and conquer algorithm for 2-way merge sort and perform its complexity analysis. (7)

b) Give Kruskal's algorithm for minimum cost spanning tree computation. Apply the algorithm to find the minimum cost spanning tree for the following graph (7)



OR

16 a) Write Dijkstra's algorithm for single source shortest path. Perform its complexity analysis. (7)

b) Write the control abstraction for Greedy design technique. Give a greedy algorithm for fractional knapsack problem. (7)

Module IV

17 a) Write Floyd Warshall algorithm for all pair shortest path problem and perform its complexity analysis. (5)

b) Define Travelling Salesman Problem. Solve the following instance of TSP using branch and bound technique. The cost matrix is given below: (9)

	A	B	C	D	E
A	-	10	8	9	7
B	10	-	10	5	6
C	8	10	-	8	9
D	9	5	8	-	6
E	7	6	9	6	-

OR

18 a) Consider the following four matrices and perform chain matrix multiplication using the dynamic programming approach. Finally give the optimal cost of multiplication and optimal parenthesization. (8)

A	B	C	D
4x5	5x3	3x2	2x7

b) Define n-queens problem. Draw the state space tree for 4-queens problem using backtracking method. (6)

Module V

19 a) Explain the benefits of randomized algorithm over deterministic algorithm. Discuss briefly the major categories of randomized algorithms. Give example for each category. (7)

b) Define bin packing problem. Discuss the first fit strategy for solving it. State the approximation ratio of the algorithm. (7)

OR

20 a) Give a randomized version of quicksort algorithm and perform its expected running time analysis. (7)

b) Prove that vertex cover problem is NP Complete. (7)

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