Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S6 (S,FE) (FT/WP/PT) Examination December 2025 (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

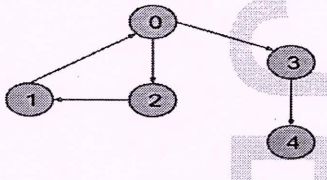
1 Let $f(n) = 3n^2 + 4n+3$.Prove that this is of the order of $\Omega(n^2)$. (3)

2 Explain masters theorem. Solve the following recurrence relation using masters theorem. (3)

$$T(n) = 3T(n/2) + n^2$$

3 Explain union and find operations in disjoint set data structures (3)

4 What is strongly connected components in a graph. Find the SCC of given graph (3)



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

6 Explain Kruskal's algorithm for finding MST. State the complexity of algorithm (3)

7 Compare backtracking with branch and bound technique (3)

8 Explain matrix chain multiplication problem (3)

9 Explain Vertex Cover problem using an example. (3)

10 Define Graph colouring problem. (3)

PART B

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

Module I

11 a) Solve the recurrence relations using recursion tree method (8)

(a) $T(n) = 2T(n/2) + c$

(b) $T(n) = 8T(n/2)+n^2$ $T(1)=1$

b) Explain different asymptotic notations used in algorithm complexity calculation in detail. (6)

OR

12 a) (i) Analyze the best case, average case and worst case time complexity of binary search algorithm. (5)

(ii) Arrange the following function in increasing order of asymptotic complexity: (3)

$$10, \sqrt{n}, n, \log_2 n, \frac{100}{n}$$

b) Find the time complexity of the following codes (6)

(i)
```
int fun(int n){
int i,j;
for(i=1;i<=n;i++) {
for(j=1;j<n;j+=i){
    printf("%d%d", i, j);
}
}
}
```

(ii)
```
sum=0;
for(i=1;i<=n;i*=2)
 for (j=1;j<=n;j++)
  sum++ ;
```

Module II

13 a) What are AVL Trees? Explain different types of rotations performed in AVL Trees. Construct AVL tree for the given sequence of numbers (9)

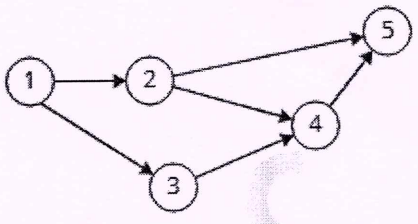
35, 50, 40, 25, 30, 60, 78, 20, 28

b) Explain the algorithm for DFS Traversal. Find its time complexity (5)

OR

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

b) Write an algorithm to find the topological ordering of graph. Find the topological ordering of the given graph (7)



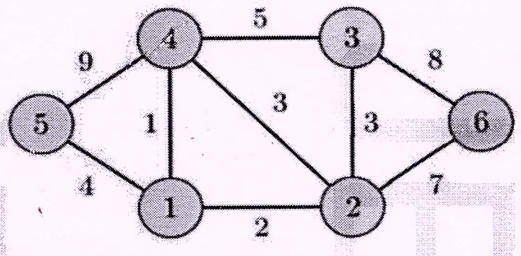
Module III

15 a) Explain 2 way merge sort algorithm using divide and conquer strategy with an example. (6)

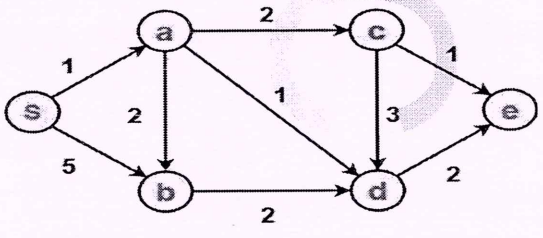
b) Formally state the fractional knapsack problem. Give an algorithm for computing an optimal solution to this problem using greedy strategy. What is its time complexity? Justify your answer. (8)

OR

16 a) Write kruskal's algorithm. Apply Kruskal's algorithm for finding minimum cost spanning tree. (7)

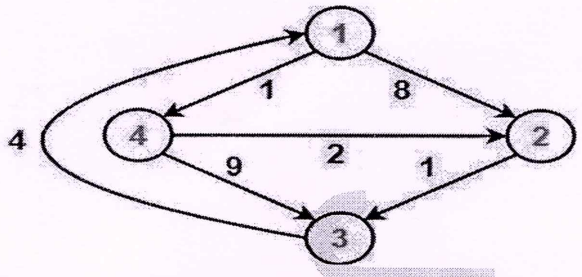


b) Using Dijkstra's Algorithm, find the shortest distance from source vertex 'S' to remaining vertices in the following graph. Also write the order of visit. (7)



Module IV

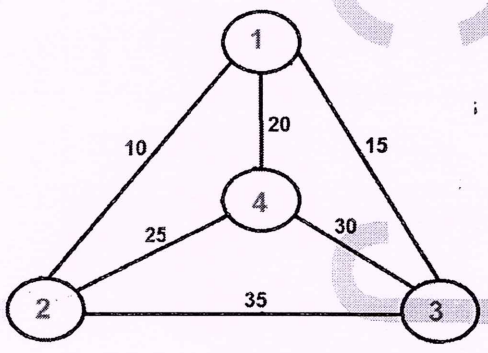
17 a) Using Floyd Warshall Algorithm, find the shortest path distance between every pair of vertices. (7)



b) We are given the sequence {5,6,4,2,3}. The matrices have size 5x6, 6x4, 4x2, 2x3. Compute M[1,4] using matrix chain multiplication algorithm. Also write the optimal paranthesis (7)

OR

18 a) Define Travelling Salesman Problem. Solve the following instance of TSP using branch and bound technique (8)



b) Explain 4 queen problem. Draw the state space tree for 4 queen problem. (6)

Module V

19 a) State bin packing problem? Explain the first fit decreasing strategy (7)

b) Explain the need for randomized algorithms. Differentiate Las Vegas and Monte Carlo algorithms. (7)

OR

20 a) Prove that clique problem is NP Complete (7)

b) Explain randomized quick sort with the help of suitable examples (7)

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