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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**

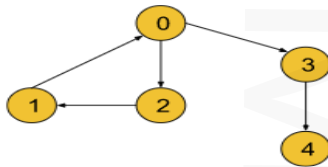
Max. Marks: 100

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);
        }
    }
}
```

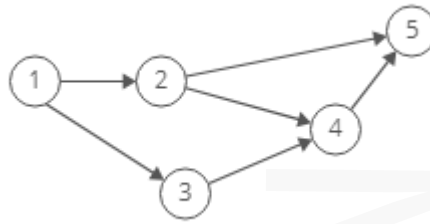
```
(ii) sum=0;
for(i=1;i<=n;i*=2)
    for (j=1;j<=n;j++)
        sum++ ;
```

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)

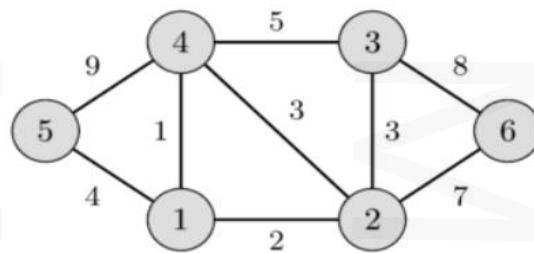


Module III

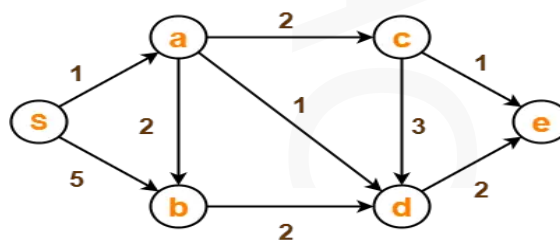
- 15 a) Explain 2 way merge sort algorithm using divide and conquer strategy with an example. (6)
- b) Formally state the fractional knapsack problem. Give an algorithm for computing an optimal solution to this problem using greedy strategy. What is its time complexity? Justify your answer. (8)

OR

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

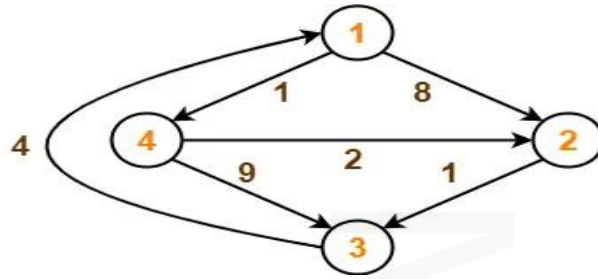


- b) Using Dijkstra's Algorithm, find the shortest distance from source vertex 'S' to remaining vertices in the following graph. Also write the order of visit. (7)



Module IV

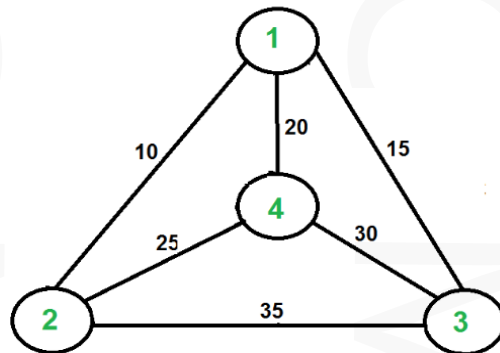
- 17 a) Using Floyd Warshall Algorithm, find the shortest path distance between every pair of vertices. (7)



- b) We are given the sequence $\{5, 6, 4, 2, 3\}$. The matrices have size 5×6 , 6×4 , 4×2 , 2×3 . 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)
