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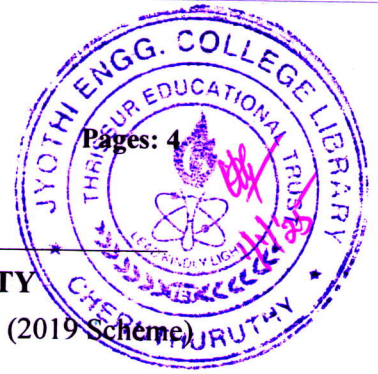
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Reg No.: _____

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S6 (S, FE) / S6 (PT) (S, FE) Examination December 2024 (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 | Arrange the functions in the increasing order of their asymptotic growth rate
$2^n, n^{\log n}, n^2, n^{\sqrt{n}}$ | (3) |
| 2 | Explain the best case and worst case search operation in a binary search tree | (3) |
| 3 | Construct AVL tree for the following data 21,26,30,9,4,14,28 | (3) |
| 4 | Show the UNION operation using linked list representation of disjoint sets. | (3) |
| 5 | Give the control abstraction of Greedy strategy | (3) |
| 6 | Compare Strassen's matrix multiplication with ordinary matrix multiplication | (3) |
| 7 | Compare backtracking with branch and bound technique | (3) |
| 8 | Illustrate how optimal substructure property could be maintained in Floyd
Warshall algorithm. | (3) |
| 9 | Explain P, NP and NP Hard Problems with examples | (3) |
| 10 | Compare Monte Carlo and Las Vegas algorithms | (3) |

PART B*Answer one full question from each module, each carries 14 marks.***Module I**

- 11 a) Find the time complexity of the following codes (6)
- ```

(i) int fun(int n){
 int i, j;
 for(i=0; i<n; i++) {
 for(j=0; j<i; j++){
 printf("%d%d", i, j);
 }
 }
}

```

```

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

```

- b) State and Explain masters theorem. Using masters theorem find the complexity of given functions (8)

- (i)  $T(n) = 2T(n/2) + n \log n$   
(ii)  $T(n) = 64T(n/8) - n^2 \log n$

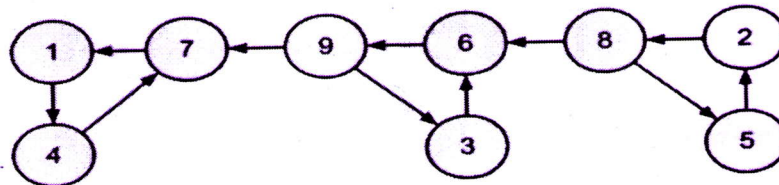
OR

- 12 a) Using recursion tree method, solve the recurrence equations (8)
- (i)  $T(n) = T(n/5) + T(4n/5) + n$   
(ii)  $T(n) = 3T(n/4) + cn^2$

- b) Explain with examples, different notations used in asymptotic analysis (6)

## Module II

- 13 a) What are strongly connected components of a graph, Explain the algorithm to find the SCC. Also find the strongly connected components of a given graph (8)



- b) Explain DFS algorithm of a graph. Also find the time complexity of the algorithm (6)

OR

- 14 a) What are the rules to be followed while deleting an element from AVL trees? (8)  
Construct an AVL trees with the following data: 44, 17, 32, 78, 50, 88, 48, 62, 84, 92, 80, 82. Also delete the elements 62, 84, 78, 17. Explain each steps.
- b) Explain BFS algorithm of a graph. Also find the time complexity of the algorithm (6)

## Module III

- 15 a) Explain 2- way merge sort algorithm with an example and derive its time complexity. (7)

b) Given Objects:

(7)

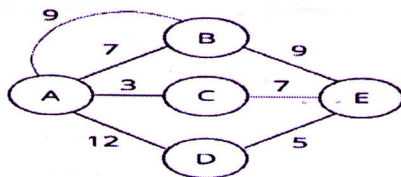
|             | 1 | 2  | 3  | 4 | 5 | 6 | 7 |
|-------------|---|----|----|---|---|---|---|
| Profit (P): | 5 | 10 | 15 | 7 | 8 | 9 | 4 |
| Weight(w):  | 1 | 3  | 5  | 4 | 1 | 3 | 2 |

W (Weight of the knapsack): 15

Find the optimal solution for the following Fractional Knapsack problem.

OR

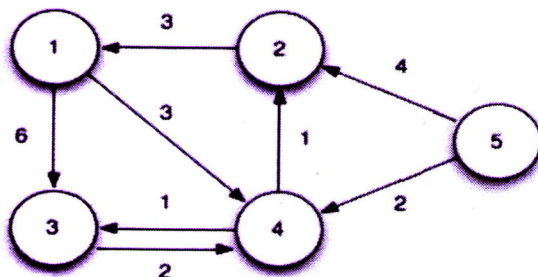
- 16 a) Write Dijkstra's algorithm for single source shortest path. Perform its complexity analysis. (7)
- b) Find the cost of Minimal Spanning Tree of the given graph by using Kruskal's Algorithm (7)

**Module IV**

- 17 a) Explain the concept of Backtracking method using 4 Queens problem. (6)
- b) Given the chain of 4 matrices A1, A2, A3, A4 with sequence of dimensions 5x6, 6x4, 4x2, 2x3. Using Matrix chain multiplication, find the optimal paranthesis of the given problem. (8)

OR

- 18 a) Using Floyd Warshall Algorithm, find the shortest path distance between every pair of vertices. (8)



- b) Explain how Travelling Salesman Problem can be solved using Branch and Bound method. (6)

**Module V**

- 19 a) Prove that Clique problem is NP Hard (7)  
b) Define Bin Packing problem. Give the First Fit heuristic approximation for this problem. What is the approximation ratio of this heuristic? (7)

**OR**

- 20 a) Prove that vertex cover problem is NP Complete (7)  
b) Explain randomized quick sort with the help of suitable examples (7)

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