

Reg No.: \_\_\_\_\_

Name: \_\_\_\_\_

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**  
**SIXTH SEMESTER B.TECH DEGREE(S) EXAMINATION(S), DECEMBER 2019**

**Course Code: CS302**

**Course Name: DESIGN AND ANALYSIS OF ALGORITHMS**

Max. Marks: 100

Duration: 3 Hours

**PART A**

*Answer all questions, each carries 3 marks.*

Marks

- |   |   |     |
|---|---|-----|
| 1 | Analyse the complexity of the following function<br><pre>void function(int n) {     int count = 0;     for (int i=n/2; i&lt;=n; i++)         for (int j=1; j&lt;=n; j = 2 * j)             for (int k=1; k&lt;=n; k = k * 2)                 count++; }</pre> | (3) |
| 2 | Solve using Iteration method $T(n)=2T(n/2)+n, T(1)=1$   | (3) |
| 3 | Define B-tree. Discuss the significance of B-tree   | (3) |
| 4 | Explain Asymptotic notations in algorithm analysis  | (3) |

**PART B**

*Answer any two full questions, each carries 9 marks.*

- |   |   |  |
|---|---|--|
| 5 | <p>a) Solve using Recursion Tree method (5)</p> $T(n)=3T(n/4)+n^2$  |  |
|   | <p>b) Analyse the complexity of the following functions (4)</p> <p>i) function(int n)</p> <pre>{     if (n==1) return;     for (int i=1; i&lt;=n; i++)         { for (int j=1; j&lt;=n; j++)             { printf("*"); break; }         } }</pre> <p>ii) void function(int n)</p> <pre>{     int i = 1, s = 1;     while (s &lt;= n)     {         i++;         s += i;         printf("*");     } }</pre> |  |

- 6 a) Construct a Red Black tree by inserting 10,20,30,15,16 and 27 into an initially empty tree and also delete 15,16 and 30 from the tree (9)
- 7 a) Solve using Masters theorem (5)
- $T(n)=2T(n/4)+\sqrt{n}$
  - $T(n)=7T(n/2)+n^2$
- b) Explain AVL rotations with examples (4)

### PART C

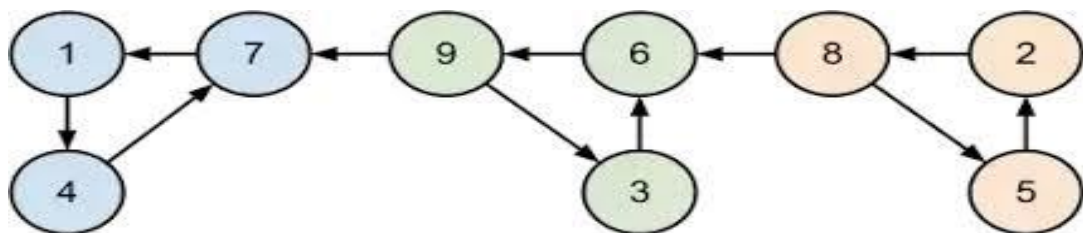
*Answer all questions, each carries 3 marks.*

- 8 Define spanning tree of a graph. Write the total number of spanning trees possible for a complete graph with 6 vertices. (3)
- 9 Write the applications of BFS and DFS (3)
- 10 List and explain the characteristic properties associated with a problem that can be solved using dynamic programming. (3)
- 11 Explain Divide and Conquer strategy. (3)

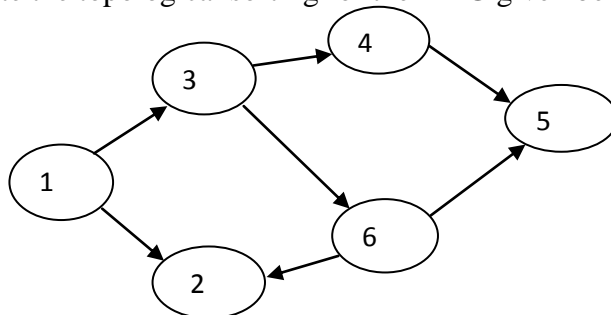
### PART D

*Answer any two full questions, each carries 9 marks.*

- 12 a) What are different classification of edges that can be encountered during DFS operation and how it is classified? Explain with example (4)
- b) Find strongly connected components of the digraph using the algorithm showing each step (3)



- c) Write the topological sorting for the DAG given below (2)

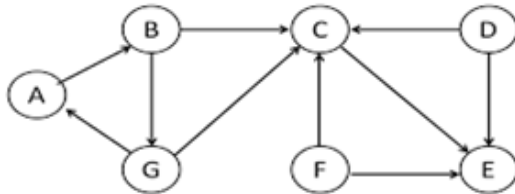


- 13 a) Given a chain of 4 matrices  $\langle A_1, A_2, A_3, A_4 \rangle$  with dimensions  $\langle 5 \times 4 \rangle, \langle 4 \times 6 \rangle, \langle 6 \times 2 \rangle, \langle 2 \times 7 \rangle$  respectively. Using Dynamic programming find the minimum number of scalar multiplications needed and also write the optimal multiplication order. (5)

- b) Write down Bellman Ford algorithm and analyse the complexity. What is the time complexity of Bellman-Ford single-source shortest path algorithm on a complete graph of  $n$  vertices? (4)

- 14 a) Write a short note on graph traversals (2)

Perform BFS traversal on the above graph starting from node A. If multiple node choices may be available for next travel, choose the next node in alphabetical order. (2)



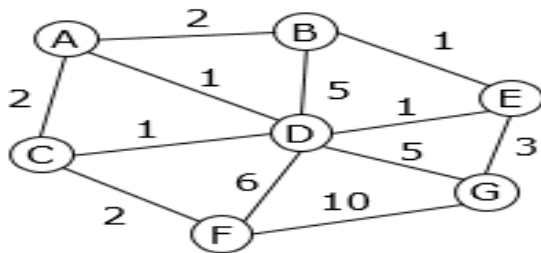
- b) Explain Strassen's matrix multiplication and analyse its complexity (5)

### PART E

*Answer any four full questions, each carries 10 marks.*

- 15 a) Give a comparison between dynamic programming and Divide and conquer strategy (4)

- b) Apply Prim's algorithm on the following graph. Let A be the source vertex (6)



- 16 a) Formulate Fractional Knapsack Problem. Write Greedy Algorithm for fractional Knapsack Problem. (5)

- b) Find the optimal solution for the following fractional Knapsack problem. Given number of items  $(n)=4$ , capacity of sack  $(m) = 60$ ,  $W=\{40,10,20,24\}$  and  $P=\{280,100,120,120\}$  (5)

- 17 a) Define NP hard and NP-Complete problems (4)

- b) Write short notes on Polynomial time reductions with example (4)

- c) Define class P and class NP (2)

- 18 a) Define Travelling Salesman Problem (TSP). Explain the basic steps that are to be followed to solve TSP using branch and bound with an example. (10)
- 19 a) Write the Kruskal's algorithm for finding minimum cost spanning tree and explain the Kruskal's algorithm with an example. Analyse the complexity of the algorithm. (7)
- b) Explain greedy strategy (3)
- 20 a) State and explain N-queens problem (2)
- b) Draw the state space tree of 4-queens problem (5)
- c) Define backtracking strategy (3)

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