

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 Define the terms Best case, Worst case and Average case time complexities. (3)
- 2 Analyse the complexity of the following function: (3)
- ```
void function(int n)
{
 int count = 0;
 for (int i=n/2; i<=n; i++)
 for (int j=1; j<=n; j = 2 * j)
 for (int k=1; k<=n; k = k * 2)
 count++;
}
```
- 3 List out the properties of red-black tree. (3)
- 4 What is meant by height balanced tree? Give examples. (3)

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

- 5 a) Solve using iteration method. (4)
- i)  $T(n) = 2 T(n/2) + n$
- ii)  $T(n) = 2 T(n/2) + n^2$
- b) Solve the recurrence using recursion tree method: (5)
- $T(1) = 1$
- $T(n) = 3T(n/4) + cn^2$
- 6 a) State Master's theorem. (3)
- b) Solve using Masters theorem: (6)
- i)  $T(n) = 3 T(n/4) + n \log n$
- ii)  $T(n) = 9 T(n/3) + n$

- 7 a) Construct a Red Black tree by inserting 10, 20, 30, 15, 16 and 27 into an initially empty tree. (5)
- b) What do you mean by asymptotic growth rate? Define Big Oh, Big Omega and Theta notion. (4)

**PART C**

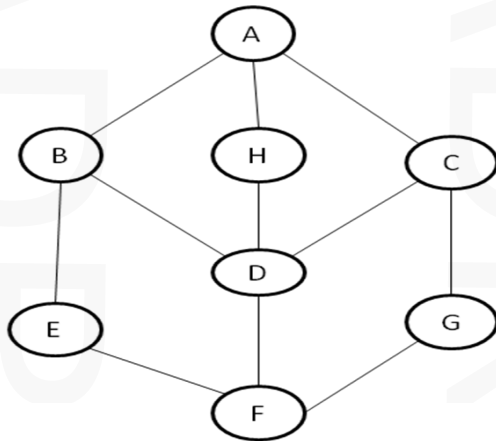
*Answer all questions, each carries 3 marks.*

- 8 Define spanning tree of a graph. Write the total number of spanning trees possible for a complete graph with 4 vertices. (3)
- 9 Write the algorithm to find Strongly Connected Components in a graph. (3)
- 10 Explain Divide and Conquer strategy with example. (3)
- 11 What are the characteristics required by problems so that they can be solved by dynamic programming approach? (3)

**PART D**

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

- 12 Apply these algorithms on the following graph. Let A be the source vertex. Analyse complexity of each algorithm. (9)
- i) BFS ii) DFS

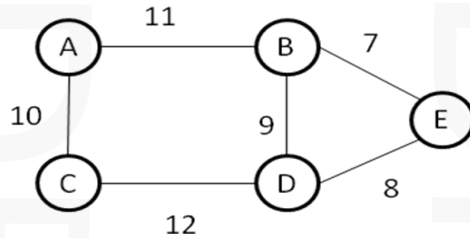


- 13 a) Write down and explain Bellman Ford algorithm. Will your algorithm detect all negative cycles in the graph? Justify your answer. (4)
- b) Explain Strassen's matrix multiplication with example and analyse its complexity. (5)
- 14 a) Write Dijkstra's Single Source Shortest path algorithm and illustrate with example. (5)
- b) Write an algorithm to merge 2 sorted arrays into a single sorted array. (4)

## PART E

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

- 15 Apply these algorithms on the following graph. Let A be the source vertex. (10)  
Analyse complexity of each algorithm.  
i) Prim's ii) Kruskal



- 16 a) Give a comparison between dynamic programming and divide and conquer strategy. (3)  
b) Explain greedy approach. Write general Greedy Algorithm. (5)  
c) Explain the differences between Prim's and Kruskal's Minimum Spanning Tree algorithms. (2)
- 17 a) Formulate fractional Knapsack problem. Write greedy algorithm for fractional Knapsack problem. (4)  
b) Find optimal solution for the following Knapsack problem. (6)  
 $n=3, m=20, W=\{ 18,15,10 \}, P=\{25,24, 20 \}$
- 18 Define N-Queens problem. Write down and explain an algorithm to solve N-Queens problem using Backtracking technique. Illustrate it with suitable example. (10)
- 19 a) Define NP-Hard and NP-complete problems. (4)  
b) What do you mean by intractable problems? (2)  
c) Write notes on polynomial time reducibility. Give examples. (4)
- 20 a) Define Travelling Salesman Problem (TSP). (3)  
b) Explain the basic steps that are to be followed to solve TSP using branch and bound. Illustrate with an example. (7)

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