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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Sixth Semester B.Tech Degree (S,FE) Examination May 2023 (2015 Scheme)

Course Code: CS302

Course Name: DESIGN AND ANALYSIS OF ALGORITHMS

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries3 marks. Marks

1 Find the time complexity of the algorithm that find the number of digits in the binary representation of a positive decimal number. (3)

2 Give the recurrence equation for the binary search algorithm. Solve the equation using iteration method. (3)

3 For the function $f(n) = 27n^2 + 16n$, express asymptotic complexity using the θ notation. (3)

4 Define B-trees. Give example. (3)

PART B

Answer any two full questions, each carries9 marks.

5 What is meant by red black tree? Insert the numbers 2, 1, 4, 5, 9, 3, 6, 7 into an initially empty red black tree. (9)

6 a) Solve using recursion tree method: $T(n) = T(n/2) + T(n/4) + T(n/8) + n$ (4)

b) Solve the given recurrence relation using iteration method: (5)

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

$T(1)=1$.

7 a) Solve using Masters theorem: (6)

i) $T(n) = 3\,T(n/4) + n \log n$

ii) $T(n) = 9\,T(n/3) + n$

b) Discuss the terms : best case, worst case and average case in algorithm analysis (3)

PART C

Answer all questions, each carries3 marks.

8 Give the control abstraction for divide and conquer strategy. (3)

9 Show that if each edge has a distinct weight, then there will be only one, i.e., a unique minimum spanning tree. (3)

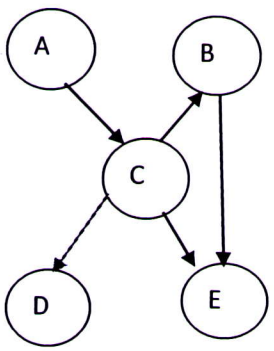
10 Compare DFS and BFS. (3)

11 How is the efficiency improved when a chain of matrices is multiplied using dynamic programming approach? (3)

PART D

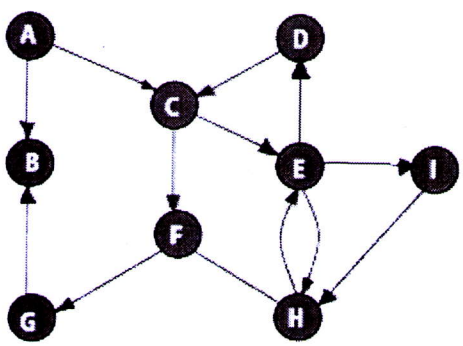
Answer any two full questions, each carries9 marks.

12 What do you mean by topological sort? Apply DFS based topological sorting algorithm to the following digraph. (9)



13 Write and explain Strassen's algorithm for multiplying two n x n matrices. Illustrate its working with the help of an example. Analyse its complexity. (9)

14 a) Apply BFS on the given graph (Take A as the starting vertex). Also, analyze the time complexity of BFS algorithm. (6)



b) Explain the steps in dynamic programming approach. (3)

PART E

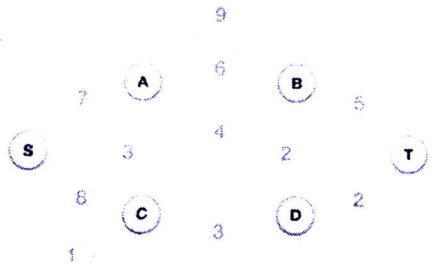
Answer any four full questions, each carries10 marks.

15 a) Compare divide and conquer strategy with dynamic programming. (4)

b) Solve the fractional knapsack problem, given the capacity of the knapsack $W =$ **60** and the list of provided items are shown in the following table. (6)

Item	A	B	C	D
Profit	280	100	120	120
Weight	40	10	20	24

16 Write Prim's algorithm. Apply prims algorithm to find the minimum spanning tree of the given graph. (10)



17 a) Write the control abstraction for the greedy approach. (5)

b) List the advantages and disadvantages of greedy approach. (3)

c) What is the difference between 0-1 knapsack and fractional knapsack problems? (2)

18 Solve the N-queens problem with the help of pseudocode. Illustrate 4 queens problem using state space tree. (10)

19 a) Give the relationship between P, NP, NP hard and NP Complete problems. (5)

b) Explain polynomial time reduction with the help of an example. (5)

20 State travelling salesperson problem. With the help of example, explain how TSP is solved using branch and bound technique. (10)

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