Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Sixth Semester B.Tech Degree (S,FE) Examination May 2022 (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 given program segment. (3)

```
for (int i = 1; i <= n; i++) {
    for (int j = i+1; j <= n; j++) {
        // code }}
```

2 Discuss the best case and worst case complexity of linear search algorithm. (3)

3 Create a red-black tree with elements 3, 21, 32 and 15 into an empty tree. (3)

4 Solve the recurrence equation using master theorem. (3)

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

PART B

Answer any two full questions, each carries9 marks.

5 a) Find the time complexity of given function using recursion tree method. (3)

$T(n) = 2\ T(n/2) + n$ where $n > 1$

0 otherwise

b) Calculate the time complexity of the following program segments. (3)

(i)
```
for (int i=1; i<=n; i++) {
    for (int j=1; j<=i*i; j++) {
        for (k=1; k<=n/2; k++) {
            //code}}}
```

(ii) (3)
```
for (int i=1; i<=n; i++) {
    for (int j=1; j<=i; j++) {
        for (k=1; k<=100; k++) {
            //code}}}
```

6 a) Write an algorithm for insertion sort. Calculate the worst time complexity of insertion sort. (4)

b) Construct AVL tree with following nodes. (5)

50, 20, 60, 10, 8, 15, 32, 46, 11, 48

7 a) Explain the asymptotic notations used for representing time complexity of a function. (4)

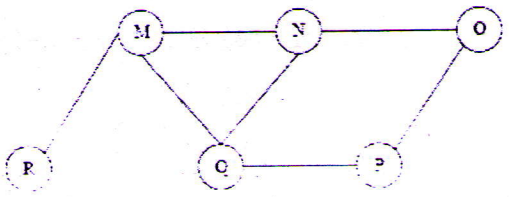
b) Insert the following elements into a B tree with minimum degree 3. (5)

10, 20, 30, 40, 50, 60, 70, 80

PART C

Answer all questions, each carries 3 marks.

8 Write the BFS traversal of given graph. Consider M as start vertex. (3)



9 Define strongly connected component of a graph. Give one example. (3)

10 Compare the time complexity of Strassen's matrix multiplication with ordinary matrix multiplication. Which algorithm run faster? Why? (3)

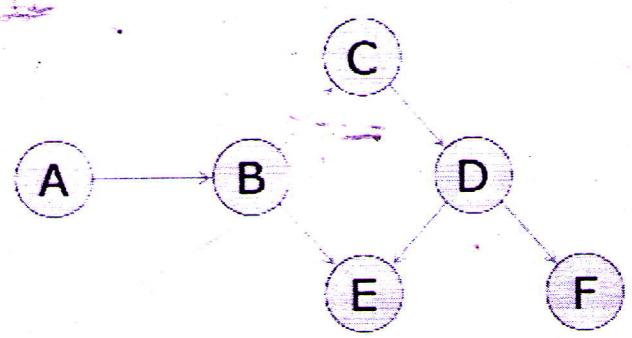
11 Explain the desirable characteristics of problems that can be solved using dynamic programming. (3)

PART D

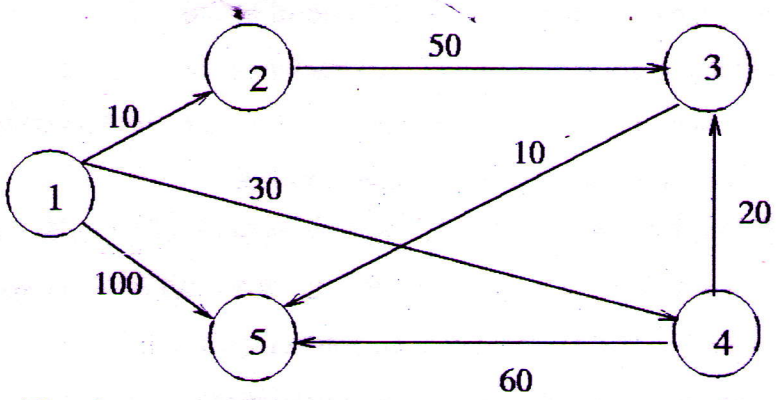
Answer any two full questions, each carries 9 marks.

12 a) What is meant by topological sorting? Write the algorithm to do topological sorting in a directed acyclic graph. (6)

b) Write the topological order of the graph G. (3)



13 a) Find the minimum path from the source vertex 1 to all other nodes using Dijkstra's algorithm. (5)



b) Write an algorithm for two-way merge sort. Calculate the time complexity of merge sort. (4)

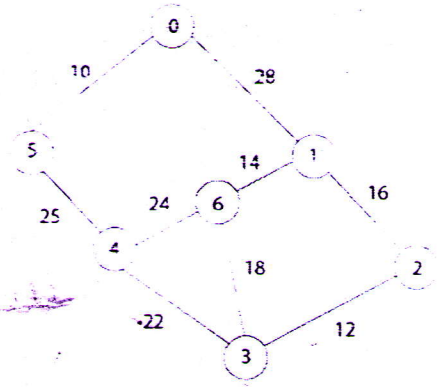
14 Find the optimal matrix chain multiplication of matrices < A1 A2 A3 A4 > whose dimensions are <5 X 4>, <4 x 6>, <6 X 2> and <2 X 7> respectively. (9)

PART E

Answer any four full questions, each carries 10 marks.

15 a) Write Prim's algorithm for finding minimum cost spanning tree. (4)

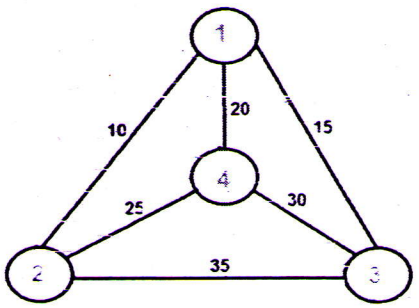
b) Find the minimum cost spanning tree for the given graph using Prim's algorithm. (6)



16 a) For the given set of items and knapsack capacity = 60 kg, find the optimal solution for the fractional knapsack problem making use of greedy approach. (6)

Item	Weight	Value
1	5	30
2	10	40
3	15	45
4	22	77
5	25	90

	b)	Compare divide and conquer and dynamic programming approaches.	(4)
17	a)	Explain the difference between Prim's and Kruskal's algorithm.	(3)
	b)	Analyse the complexities of Prim's algorithm and Kruskal's algorithm.	(7)
18	a)	Write the control abstraction of backtracking approach.	(2)
	b)	Explain how 4 queen problems can be solved using backtracking approach.	(5)
	c)	Draw the state space tree of 4 queen problem.	(3)
19	a)	A knapsack that can carry a maximum weight of 60. There are 4 items with weights {20, 30, 40, 70} and values {70, 80, 90, 200}. What is the maximum value of the items you can carry using the knapsack?	(4)
	b)	Find the minimum TSP tour for the given graph.	(6)



20	a)	Compare tractable and intractable problems. Give one example to each.	(3)
	b)	Define P, NP, NP complete and NP hard problems.	(4)
	c)	With examples explain polynomial time reducibility.	(3)

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