Duration: 2hrs **[Max Marks:60]**

N.B.: (1) Question No 1 is Compulsory.
(2) Attempt any three questions out of the remaining five.
(3) All questions carry equal marks.
(4) Assume suitable data, if required, and state it clearly.

1 **Attempt any THREE** **[15]**

a Define an AVL tree. Explain the concept of rotations in AVL trees.

b Apply Fractional Knapsack algorithm for the following data:
Items: A, B, C, D
Profits: 40, 50, 100, 90
Weights: 10, 20, 30, 30
Knapsack Capacity: 60

c Solve the 4-Queens problem using backtracking and show one valid board arrangement.

d Differentiate between 0/1 Knapsack and Fractional Knapsack.

2 **a** Solve the recurrence relation using recursion tree method: $T(n) = 3T(n/4) + n^2$ **[07]**

b Insert the following keys into a B-tree of order 5. **[08]**
Show the tree after each split: 25, 37, 80, 10, 65, 50, 60, 90, 70, 85

3 **a** Given n=7 items with profits p={10,5,15,7,6,18,3}, weights w={5,2,3,5,7,2,4}, and knapsack capacity m=15, solve the fractional knapsack problem using the greedy profit/weight ratio rule and report the optimal total profit and the fraction of each item selected (x_1,…,x_7). **[07]**

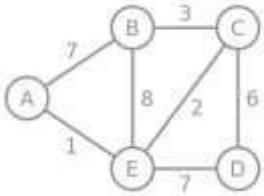
b Apply backtracking to find all subsets with sum 15 from the set: **[08]**
{1, 3, 5, 7, 9, 11}

4 **a** Given a weighted directed graph with 4 vertices, apply the Floyd-Warshall's algorithm to compute the all-pairs shortest path matrix. **[07]**

From / To	1	2	3	4
1	0	3	∞	7
2	8	0	2	∞
3	5	∞	0	1
4	2	∞	∞	0

X525Y15A414X525Y15A414X525Y15A414X525Y15A414

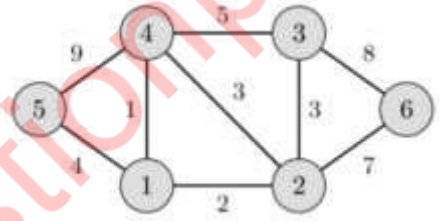
b Using Dijkstra's Algorithm to determine the shortest path from source node A to all other nodes. Show the detailed working. **[08]**



5 **a** Given the following adjacency list, perform BFS and DFS starting from A: **[07]**
A: B, C
B: A, D, E
C: A, F
D: B
E: B, F
F: C, E

b Explain KMP (Knuth–Morris–Pratt) algorithm. Then use this to perform pattern matching on the text T = "BACBABABABACACA" and pattern P = "ABABACA". **[08]**

6 **a** Apply Prim's Algorithm and Kruskal's Algorithm on the following weighted graph and find the Minimum Spanning Tree (MST). Also calculate the total cost of MST. **[07]**



b Explain the naive string-matching algorithm. For text T = "ABABABC" and pattern P = "ABC", show all character comparisons clearly. **[08]**

X525Y15A414X525Y15A414X525Y15A414X525Y15A414