

Duration: 2hrs

[Max Marks: 60]

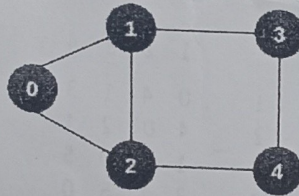
- N.B.: (1) Question No 1 is Compulsory.  
 (2) Attempt **any three** questions out of the remaining five.  
 (3) All questions carry equal marks.  
 (4) Assume suitable data, if required, and state it clearly.

1 Attempt any **THREE** [15]

- a Define time complexity and space complexity. Explain the difference between worst-case, average-case, and best-case complexity.
- b Define an AVL tree. Explain the concept of rotations in AVL trees.
- c Find Minimum Spanning Tree of the following undirected graph using Prim's Algorithm.  
 $Cost(1, 2) = 250, Cost(1, 3) = 180, Cost(1, 4) = 100,$   
 $Cost(2, 3) = 50, Cost(2, 5) = 10, Cost(3, 4) = 20, Cost(4, 5) = 40$
- d Describe the graph coloring problem with example.

2 a What is "Master Theorem" in recurrence relation. Find the complexity of following recurrence relation using Master Theorem. [07]  
 $T(n) = 4T(n/2) + n^3$

b Given a graph, apply BFS and DFS traversals on it with corresponding data structure implementation. [08]



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  $(x_1, \dots, x_7)$ . [07]

b Given a weighted directed graph with 4 vertices, apply the Floyd-Warshall's algorithm to compute the all-pairs shortest path matrix. [08]

From / To	1	2	3	4
1	0	3	$\infty$	7
2	8	0	2	$\infty$
3	5	$\infty$	0	1
4	2	$\infty$	$\infty$	0

