

- NB:
1. Answer any **THREE** questions out of four from each PART.
  2. Figures in the right margin indicate marks.
  3. Parts of the same question should be answered together and in the same sequence.

Time: 3 Hours

Total Marks: 70

**PART-A**

- a) Define data structure. Differentiate between linear and nonlinear data structure. 3.67
  - b) Let BALANCE [100:500] is a linear array, Base (BALANCE) = 200 and  $w = 4$  words/memory cell. Find LOC (BALANCE [300]) and comment on the indexing property of BALANCE. 2
  - c) Write binary search algorithm and compare with linear search algorithm based on complexity. 6
- a) Define the terms "overflow, underflow, and header linked list". 3.67
  - b) Given an integer K, write a procedure with explanation which deletes the  $K^{th}$  element from a linked list. 4
  - c) Write a procedure with explanation which adds a given ITEM of information at the middle of a list. 4
- a) Give that following list of 12 numbers: 6.67  
44, 33, 11, 55, 77, 90, 40, 60, 99, 22, 88, and 66.  
Use the quick sort algorithm to find the final position of the first number 44.
  - b) Write Huffman's algorithm and simulate it with the following data items and weights: 5  

Data item:	A	B	F	N	Q
Weight:	22	5	11	19	13
- a) Build a maxheap from the following numbers: 5  
41, 27, 47, 19, 57, 52, 74, 52.
  - b) What is binary tree? Explain its uses. 2
  - c) Write a preorder traversing algorithm of a binary tree. 4.67

**PART-B**

- a) Define algorithm. What kind of problems are solved by algorithms? 3.67
  - b) Analyze insertion sort algorithm for best and average case in terms of time and cost. 4
  - c) What is asymptotic notation? For a given function  $f(n) = 7n^2 + 5n$  find the big O notation. 4

6. a) Consider the following example of knapsack problem, where single copy of each item is available.

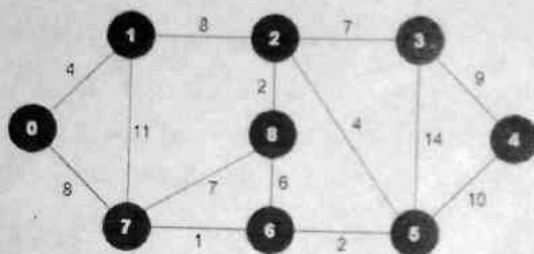
5.67

	weight	value
Item 1	1	5
Item 2	2	11
Item 3	3	18
Item 4	4	22

For  $M = 5$ , which items should be picked to get optimal solution and what will be the total value?

- b) i) For the given graph, find a minimum spanning tree using prim's algorithm.

6



- ii) Find the total number of possible spanning trees for the given graph.  
 iii) What is the time complexity of kruskal's algorithm? Which method can be used to reduce this complexity?

7. a) What is dynamic programming? What problems can be solved using dynamic programming?

3.67

- b) Define multistage graph. With an example explain the concept of multistage graph.

5

- c) What do you mean by shortest path problem? Why it is important in graph theory?

3

8. a) In which cases we have to use backtracking technique? State the main difference between "Backtracking" and "Branch and bound" technique.

2.67

- b) The 'n' queens problem is the problem of placing n queens on an nxn chessboard such that no queen can attack another queen. In other words, no two queens share the same row, column or diagonal.

6

Draw the state space tree to get possible solutions of a 4 queen problem.

- c) Write an algorithm to find Hamiltonian cycle in a graph.

3