

**Third Semester B. E. (Computer Science and Engineering)  
Examination**

**DATA STRUCTURES AND PROGRAM DESIGN**

Time : 3 Hours]

[Max. Marks : 60

**Instructions to Candidates :—**

- (1) All questions carry marks as indicated.
- (2) Assume suitable data wherever necessary and provide appropriate trace of algorithms.

1. (a) Determine the frequency count for the given program fragment using tabular method.

```
for i = 3 to n
  for j = 1 to i
    x = x + 1;
  end
end
```

2(CO1)

- (b) Consider an array A of size [5x4x3]. Represent the given array in memory and compute address for the element A [2, 3, 2] assuming base address as 201 and size of each array element as 4. 3(CO1)
- (c) Write an algorithm to transform infix expression to postfix expression. Apply the same for translating given infix expression to postfix expression.

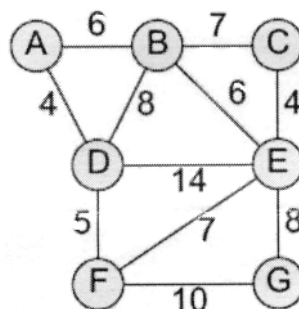
$(A + B) * C/D + E^F/G$

5(CO1)

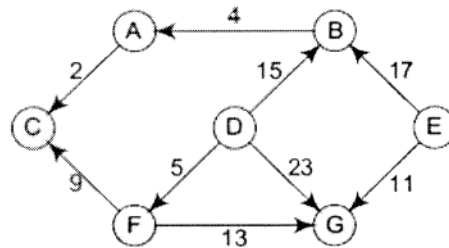
2. Solve any **Two** :

- (a) Write a C program using function to split a given a singly linked list into two sub linked lists, at the middle node. All I/O should be considered in main function only. 5(CO1)
- (b) Consider a singly linked list and write C functions.
  - (1) To insert the given key in ordered list.
  - (2) To delete last element. 5(CO1)

- (c) Given a doubly linked list, write pseudo-code to delete a node from the list (consider all cases). 5(CO1)
3. (a) Explain each of the following with suitable example :
- (1) Array representation of Binary Tree.
  - (2) Skewed Binary Search Tree
  - (3) Complete binary tree
  - (4) Full Binary Tree
  - (5) Multi-way Search Tree. 5(CO2)
- (b) What is AVL Tree and how is an AVL tree better than a binary search tree ? Consider the given sequence of keys 63, 9, 19, 27, 18, 108, 99, 81 and construct AVL tree. Delete nodes 27 and 99 from the AVL tree formed after solving the above question. 5(CO2)
4. (a) For the set of keys {1015, 2025, 3025, 2028, 4049, 5052, 8094, 4421, 4068, 1017, 9080, 7523, 6192}, obtain a hash table using quadratic probing and separate chaining. Consider a hash function  $h(k) = K \text{ MOD } 12$ . 5(CO3)
- (b) Give the properties of a good hash function. List out different hash functions used in hashing. Explain each with example. 5(CO3)
5. (a) Define Spanning Tree. When is a spanning tree called a minimum spanning tree ? Construct a minimum spanning tree of the graph given below using Prim's algorithm. Consider starting vertex as A. 5(CO2)



- (b) Which data structure is suitable for finding out shortest path ? Apply Dijkstra's Algorithm on given graph to find shortest path. Consider source vertex as D. Draw intermediate configurations.



5(CO2)

6. Solve any **Two** :

- (a) Sort the given sequence of numbers in descending order using heap sort, L : 42, 34, 75, 23, 21, 18, 90, 67, 78. Draw intermediate configurations of the heap. 5(CO4)
- (b) Trace the Shell Sort algorithm on the given list of keys L = {24, 37, 46, 11, 85, 47, 33, 66, 22, 84, 95, 55, 14, 09, 76, 35} for a gap sequence of H = {7, 5, 3, 1}. 5(CO4)
- (c) What do you mean by In-Place Sorting ? List any three in-place sorting techniques. Write pseudocode for Merge Sort. 5(CO4)