

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

DATA STRUCTURE AND PROGRAM DESIGN

Time : 3 Hours]

[Max. Marks : 60

Instructions to Candidates :—

- (1) All questions carry equal marks.
- (2) Assume suitable data wherever necessary.
- (3) Due credit will be given to neatness and adequate answers.

1. (a) Answer the following (any **Two**) :—

(1) Determine frequency count for the given program fragment.

```
i = 2 n ;  
for k = 1 to i  
    for j = 3 to k  
        t = t + 1  
    p = p + 2
```

(2) Consider DEQ (1 : 5) as Output restricted deque implemented as circular array. LEFT and RIGHT indicate the ends of deque as shown below. Execute the following insertions and deletions on DEQ.

LEFT		RIGHT		
1	2	3	4	5
	44	22		

- (a) INSERT (55, LEFT)
- (b) INSERT (75, RIGHT)
- (c) DELETE
- (d) INSERT (86, LEFT)
- (e) DELETE

(3) Convert given infix expression to prefix using stack.

$$a + (b * c - (d / e^f) * g) * h \quad 6(\text{CO } 1)$$

- (b) Consider an array A of size $[6 \times 6 \times 4]$. Represent the given array in memory and Compute address for the element $A[4, 3, 3]$ assuming base address as 100 and size of each array element as 4. 4 (CO 1)

2. Solve any **Two** :—

- (a) Let A and B be two linked list. Write C function to create a new linked list that contains elements alternately from A and B beginning with the first element of A. If you run out of the elements of any one list, then simply append the remaining elements of other list to new list. 5 (CO 1)
- (b) What are the limitations of array data structure ? Show with the help of an example, how the limitations can be avoided by linked list. What do you mean by linear list and generalized list ? 5 (CO 1)
- (c) Write a C function for each of the following using doubly linked list.
- (1) Insertion at specified position
 - (2) Sorting of linked list. 5 (CO 1)

3. (a) Construct a Binary Search Tree for the given sequence.
18, 14, 25, 29, 13, 012, 24, 15, 10, 17

Write a C function to print all the nodes level wise, for the constructed tree. Your C function should print the nodes of all levels in separate lines. 5 (CO 2)

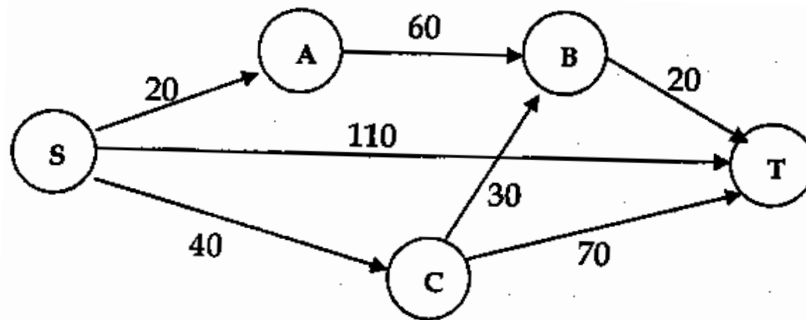
- (b) What is AVL Tree ? Explain the need for AVL Tree. 2 (CO 2)
- (c) Consider the given sequence of keys 10, 24, 23, 11, 31, 16, 26, 35, 29, 20, 46, 28, 13, 27, 33, 21. Insert the keys in an empty B-Tree having order, $M = 5$.
Draw the configurations of the tree for splitting of any node and complete tree. 3 (CO 2)

4. (a) Compare Open Hashing and Closed Hashing based on their advantages and disadvantages.

Consider insertion of keys 10, 22, 31, 4, 15, 28, 17, 88, 59 into a hash table of length $m=11$ using separate chaining with hash function $h_1(k) = k \bmod m$. Illustrate the result of inserting keys. 5 (CO 3)

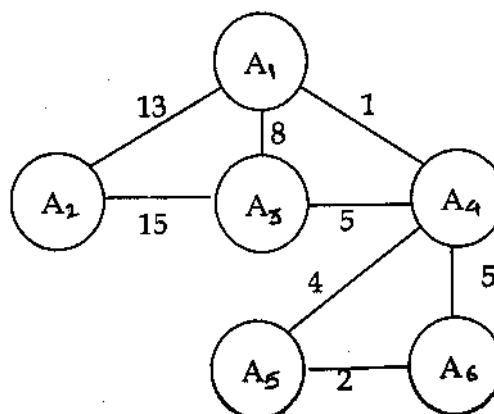
- (b) Write pseudocode for deleting any element from an open – address hash table. Mention the modifications to be carried out in pseudocode of insertion of elements in open address hash table. 5 (CO 3)

5. (a) Assume a water pipe system as in the following figure shows with weighted graph. Each arc represent a pipe and the number above each arc represents the capacity of that pipe in gallons per minute. The nodes represent points at which pipes are joined and water is transferred from one pipe to another. Two nodes 'S' and 'T' are designed as a source of water and a user of water. Water flows in only one direction. Write suitable algorithm to identify through which path the amount of water flowing from the source to the sink will be minimum and print the path.



5 (CO 2 , 4)

- (b) Write Prim's algorithm to identify minimum spanning tree of an undirected graph. Trace the algorithm for the following graph and determine the minimum spanning tree.



5 (CO 2 , 4)

6. Solve any **Two** :—

- (a) Trace Shell sort procedure on the given keys
{ 24, 37, 46, 11, 85, 47, 33, 66, 22, 84, 95, 55, 14, 09, 76, 35 } for a gap
sequence { g_3, g_2, g_1, g_0 } = { 7, 5, 3, 1 }. 5 (CO 4)
- (b) Write Pseudo–Code to implement Quick Sort. Discuss Best, Average and
Worst case of Quicksort with suitable example. 5 (CO 4)
- (c) Implement 2–way merge sort to sort the given data by considering number
of records (M) at each run as 3.
35, 17, 99, 28, 58, 81, 94, 11, 96, 12, 41, 75, 15

State how many passes will be required to get the data in sorted
manner ? State the factors on which number of passes are dependent.
5 (CO 4)