

**Third Semester B. Tech. / B. E. (Computer Science and Engineering /
Artificial Intelligence and Machine Learning / Cyber Security)
Examination**

DATA STRUCTURES / DATA STRUCTURE AND ALGORITHMS

Time : 2 Hours]

[Max. Marks : 40

Instructions to Candidates :—

- (1) All questions carry marks as indicated.
- (2) Due credit will be given to neatness.
- (3) Assume suitable data and illustrate answers with proper justification.

1.
 - (a) Write C function for iterative implementation of binary search. Compute the best case, worst case and average case time complexity for the same.
3 (CO 1)
 - (b) Represent the given array A of size $[4 \times 4 \times 3]$ in memory using row major form and column major form. Compute address for the element A[2, 3, 2] assuming base address as 1000 and size of each array element as 2.
3 (CO 1)
2.
 - (a) Consider given expression and obtain its equivalent expression in reverse polish form using stack :
$$A + (B * C - (D / E - F) * G) * H$$

2 (CO 2)
 - (b) Write pseudocode for inserting and deleting any element for Circular Queue, for array based implementation. Consider circular queue, of size 4 and show the contents for following operations :—
$$\text{Delete}(), \text{Insert}(75), \text{Insert}(90), \text{Insert}(65), \text{Insert}(80),$$

$$\text{Insert}(85), \text{Delete}(), \text{Insert}(55).$$

5 (CO 2)

3. (a) Consider following program fragment for singly linked list —

```
struct Node {
    int data ;
    struct Node *next ;
};
typedef struct Node list ;
main()
{
    list* head = NULL ;
    append (&head, 6) ;
    push (&head, 7) ;
    push (&head, 1) ;
    append (&head, 4) ;
    insertAfter (head → next, 8) ;
}
```

- (1) Write function prototype for

- append : inserts element at the end.
- push : inserts element at the beginning.
- insertAfter : inserts element after given node.

- (2) Show the contents of linked list.

- (3) Comment on need of using typedef. 3 (CO 2)

- (b) Write C function to insert a node at immediate left of j^{th} node in a doubly linked list. Trace using linked list of 5 nodes. 3 (CO 2)

4. (a) Consider given list $L = \{68, 66, 71, 69, 65, 72, 67, 70\}$. Sort the list in descending order using a tree based sorting method. Show intermediate configurations while carrying out the sort. 3 (CO 3)

- (b) Trace Shell sort procedure on the given keys $\{15, 20, 36, 93, 12, 25, 22, 99, 85, 17\}$ with a gap size of $\{5, 3, 1\}$. 3 (CO 3)

5. (a) Construct binary tree from given traversals —

Preorder : 14, 17, 9, 13, 53, 11, 4, 19, 7

Inorder : 9, 13, 17, 53, 14, 19, 4, 7, 11 2 (CO 4)

(b) 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.

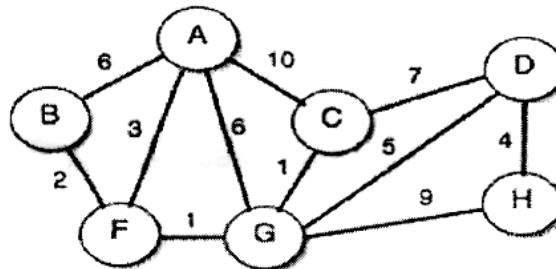
4 (CO 4)

OR

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.

4 (CO 4)

6. (a) For the set of keys {17, 9, 34, 56, 11, 4, 71, 86, 55, 10, 39, 49, 52, 82}, obtain a hash table by using quadratic probing and separate chaining. Make use of the hash function $H(X) = X \bmod 9$. 3 (CO 4)
- (b) Compute minimum cost spanning tree for the following connected graph using vertex based algorithm. Use alphabetical ordering for considering starting vertex.



4 (CO 4)

