

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

DATA STRUCTURES / DATA STRUCTURES AND ALGORITHMS

Time : 2 Hours]

[Max. Marks : 40

Instructions to Candidates :—

All questions carry marks as indicated.

1. (a) When the binary search will give —
 - (1) Worst–case performance.
 - (2) Best–case performance.
 - (3) Average–case performance.and what will be respective complexities ? 3 (CO 1)
- (b) Assume an array contains 6 numbers initially. Using Array ADT write a function `insert_at_mid()` to insert two new elements at the mid of the array. 3 (CO 1)
2. Write a C program to implement a Double Ended Queue ADT using an array. Ensure that the queue pointers are not defined as global variables. Assume that your queue can accommodate 5 elements. For your queue ADT show step–by–step trace showing contents of the array for the following call sequence —
`insert(10, 1), insert(20, 1), delete(1), insert(30, 2), insert(40, 1), insert(50, 2), insert(60, 1), insert(70, 2), delete(2), delete(2), delete(1), insert(80, 2).`
Second parameter to `insert()` and only parameter to `delete()` represent 1 for front end and 2 for rear end of DEQUE. 7 (CO 2)

3. Analyze the given code and identify the task performed by it on the array A. What will be the output of the program ? Implement a similar program for the same task using linked list :

```
#include <stdio.h>
void rearrange (int A[], int n)
{
    int k = 0, i ;
    for (i = 0 ; i < n ; i++)
    {
        if (A[i] != 0) {
            A [k++] = A[i] ;
        }
    }
    for (i = k ; i < n ; i++) {
        A[i] = 0 ;
    }
}

int main (void)
{
    int A[] = {6, 0, 8, 2, 3, 0, 4, 0, 1} ;
    int i, n = sizeof (A) / sizeof (A[0]) ;
    rearrange (A, n) ;
    for (i = 0 ; i < n ; i++) {
        printf("%d ", A[i]) ;
    }
    return 0 ;
}
```

7 (CO 2)

4. Write the algorithm for quick sort if the last element is selected as pivot. Show stepwise output of all iterations if quick sort is performed on the list :

40, 20, 10, 80, 60, 50, 7, 30, 100.

6 (CO 3)

5. (a) Construct an AVL tree from the following keys :

20, 15, 35, 50, 66, 74, 25, 30, 70, 12, 10.

Show AVL tree violations and draw resultant AVL tree at each stage.

5 (CO 4)

- (b) Define and illustrate with examples—Strict binary tree and full binary tree.

2 (CO 4)

6. (a) Write C functions to compute DFS traversals. For graph represented using an adjacency matrix, trace the DFS traversal originating at vertex A :

| | A | B | C | D | E |
|---|---|---|---|---|---|
| A | 0 | 1 | 1 | 0 | 0 |
| B | 0 | 0 | 0 | 1 | 1 |
| C | 0 | 0 | 0 | 1 | 0 |
| D | 1 | 0 | 0 | 1 | 1 |
| E | 0 | 0 | 0 | 0 | 0 |

4 (CO 4)

- (b) Consider a closed addressing scheme which randomizes the keys using —
 $h(x) = x \% 9$.

Construct the hash table when following keys are inserted in mentioned sequence —

11, 73, 14, 44, 38, 92, 66, 55, 33, 86, 82

Assume that an individual bucket can hold a single key. 3 (CO 3)

