Ref. No: Ex/IT/PC/B/T/211/2024(S)

Jadavpur University
Department of Information Technology
B. Info. Tech. 2nd Year 1st Semester Supplementary Examination 2024
Subject: Data Structures and Algorithms

Time: 3 Hrs. Full Marks: 100

(ANSWERS MUST BE BRIEF AND TO THE POINTS)
Answer any *five* questions

1. (4+5+5+6)
   a. Define the following terms: ADT, Data Structure.
   b. Define Big-O, Ω, and θ notations for measuring time complexity.
   c. Write an algorithm to delete all elements in between and occupying two specified positions from an array of size n.
   d. An array X contains 30 positive integers. Write an algorithm which will find out all pairs of elements whose product is 30. What is the time complexity of your algorithm?

2. (10+4+6)
   a. Evaluate the following postfix expression using stack :
      2 3 4 * + 8 - 5 1 + *
   b. List some example applications for stacks and queues.
   c. Given an efficient array based circular queue Q capable of holding 10 elements. Show the content of Q when the following code is executed:

```
for (int k = 1; k ≤ 7; k ++)
        Q.enqueue (k);
for (int k = 1; k ≤ 7; k ++)
        Q.enqueue (Q.dequeue());
```

3. (4+6+5+5)
   a. Write an O(1) algorithm to connect two circular linked lists.
   b. Write a C function to insert an element at specific position of a circular linked list.
   c. Write an algorithm to print the content of a single linked list in reverse order.
   d. Explain what does the following function do?

```
void fun2 (struct node * head)
{
    if (head = = NULL)
        return;
    printf ("%d", head→data);
    if (head→next != NULL)
        fun2(head→next→next);
        printf ("%d", head→data);
}
```

4. (7+7+6)
   a. Run the Quick sort algorithm on the following array to arrange the numbers in decreasing order.
      50 30 60 10 40 20 90 80 100 70
   b. Consider a hash table with 9 slots. The hash function is h(k) = k mod 9. The collisions are resolved by chaining. The following 9 keys are inserted in the order: 5, 28, 19, 15, 20, 33, 12, 17, 10. What are the maximum, minimum, and average chain lengths in the hash table?
   c. Insert the following elements on-by-one into an initially empty Max-Heap.
      1, 2, 3, 4, 5, 6, 7, 8, 9, 10

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5. (4+7+9)

a. The pre-order traversal sequence of a binary search tree is: 30, 20, 10, 15, 25, 23, 39, 35, 42. Give the post order traversal sequence of the binary search tree.

b. What is a AVL tree? Write a C program to insert new nodes to a binary search tree and delete a given node from a binary search tree.

c. Insert the following values in an empty AVL tree in the order given.
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

6. (10+10)

a. Write down algorithms for finding BFS and DFS traversal sequences of a graph.

b. Write short notes on: Linked list implementation of queue and Sparse matrix