

Jadavpur University
Department of Information Technology
B. Info. Tech 2nd year 1st semester Supplementary Examination 2023
Subject: Data Structure and Algorithms

Time: 3 Hrs.

Full Marks: 100

(ANSWERS MUST BE BRIEF AND TO THE POINTS)

Answer any five questions

1. ((2+2)+8+8)
- a. What condition must be satisfied for the list representation of sparse matrix to be advantageous over general 2-D representation of the same sparse matrix? Express the formula $(n^2-2)*(n-4)$ using big-O notation
 - b. 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?
 - c. Write an algorithm to delete all elements in between and occupying two specified positions from an array of size n.
2. (8+6+6)
- a. Evaluate the following postfix expression using stack :
2 3 4 * + 8 - 5 1 + *
 - b. Consider the following operation along with standard Enqueue and Dequeue operations on queues, where k is a global parameter.
MultiDequeue (Q)
{
 m=k;
 while (Q is not empty and m>0)
 {
 Dequeue (Q);
 m=m-1;
 }
}
- What is the worst case time complexity of a sequence of n MultiDequeue () operations on an initially empty queue.
- 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. (5+5+4+6)
- a. You are given a linked list of 0's, 1's, and 2's. Write an algorithm to sort the linked list.
 - b. Write an algorithm to print the content of a single linked list in reverse order.
 - c. Write an O(1) algorithm to connect two circular linked lists.
 - 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);
}

[Turn over

4. (6+8+6)
- Run the heap sort algorithm on the following array to arrange the numbers in decreasing order.
50 30 60 10 40 20 90 80 100 70
 - Give the best, worst, and average case time complexity of the following algorithms.
Quick sort, insertion sort, merge sort and selection sort
 - Insert the following elements on-by-one into an initially empty Max-Heap.
1, 2, 3, 4, 5, 6, 7, 8, 9, 10
5. (6+4+10)
- Define complete binary tree, full binary tree, and binary search tree with examples.
 - 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.
 - 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. (6+8+6)
- Compare between adjacency matrix and adjacency list representation of a graph.
 - Write down an algorithm for finding minimum cost spanning tree of a graph.
 - Write Dijkstra's shortest path algorithm.
7. (10+10)
- Write short notes on the following:
 - Breadth first search and Depth first search algorithms
 - Kruskal's and Prim's algorithm to find spanning tree of a given undirected graph.