

	<p align="center"> Charotar University of Science and Technology Devang Patel Institute of Advance Technology and Research (DEPSTAR) Department of Computer Engineering </p>	
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Subject: Data Structure and Algorithms

Semester: 4

Subject Code: CE245

Academic Year: 2022-23

Course Outcome (COs):

At the end of the course, the students will be able to:

1. Understand and Implement Algorithms and core Data Structures such as stack, queue, hash table, priority queue, binary search tree and graph in programming language.
2. Analyse data structures in storage, retrieval and computation of ordered or unordered data.
3. Compare alternative implementations of data structures with respect to demand and performance.
4. Describe and evaluate the properties, operations, applications, strengths and weaknesses of different data structures.
5. Apply and select the most suitable data structures to solve programming challenges.
6. Discover advantages and disadvantages of specific algorithms.

Practical List

Sr. No.	Aim of the Practical	Hrs	COs
1.	Implement Linear Search and Binary Search using array data structure.	2	1
2.	<p>In a far away Galaxy of Tilky Way, there was a planet Tarrh where the sport of Competitive Coding was very popular. According to legends, there lived a setter known for loving knapsack type problems.</p> <p>Given N objects in a row, with weights W_1, W_2, \dots, W_N, you need to find the maximum number of consecutive objects you can fill in a bag of maximum capacity C such that the total weight of objects taken is at least K.</p> <p>In other words, pick objects such that-The total weight of collected objects is at least K. The total weight does not exceed C.</p> <p>The objects picked must be consecutive (i.e. a subarray of the objects need to be picked) The number of objects is maximized. You need to print this maximum value.</p> <p>Note-If no such object could be picked, then the answer is obviously 0.</p> <p>Input</p> <ul style="list-style-type: none"> • The first line of input contains T, number of test cases in a file. • The next line contains three integers, N, C and K, as described in the problem statement. • The next line contains N space separated integers, denoting W_i, i.e. weight of the object. <p>Output</p> <ul style="list-style-type: none"> • For test case, output the maximum number of objects you can pick. <p>Input</p> <pre> 2 5 5 5 5 4 3 2 1 5 5 4 </pre>	2	2



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	<p>1 4 1 1 1</p> <p>Output</p> <p>2</p> <p>2</p>		
3.	<p>3.1 Implement following operations of singly linked list.</p> <p>(a) Insert a node at front</p> <p>(b) Insert a node at end</p> <p>(c) Insert a node after given node information</p> <p>(d) Delete a node at front</p> <p>(e) Delete a node at last</p> <p>3.2 Implement following operations of doubly linked list.</p> <p>(a) Insert a node at front</p> <p>(b) Insert a node at end</p> <p>(c) Insert a node after given node information</p> <p>(d) Delete a node at front</p> <p>(e) Count number of nodes</p> <p>3.3 Implement following operations of circular singly linked list.</p> <p>(a) Inserting a node at front</p> <p>(b) Delete a node at end</p> <p>Note: Display content of linked list after each operation.</p>	4	1,2
4.	<p>Implement Sorting Algorithm(s).</p> <p>(a) Bubble Sort</p> <p>(b) Selection Sort</p> <p>(c) Insertion Sort</p> <p>(d) Quick Sort</p>	4	3
5.	<p>Chef and his little brother are playing with sticks. They have total N sticks. Length of i-th stick is A_i. Chef asks his brother to choose any four sticks and to make a rectangle with those sticks its sides. Chef warns his brother to not to break any of the sticks, he has to use sticks as a whole. Also, he wants that the rectangle formed should have the maximum possible area among all the rectangles that Chef's brother can make. Chef's little brother takes this challenge up and overcomes it. Can you also do so? That is, you have to tell whether it is even possible to create a rectangle? If yes, then you have to tell the maximum possible area of rectangle.</p> <p>Input</p> <ul style="list-style-type: none"> The first line contains a single integer T denoting the number of test-cases. T test cases follow. The first line of each test case contains a single integer N denoting the number of sticks. The second line of each test case contains N space-separated integers A_1, A_2, \dots, A_N denoting the lengths of sticks. <p>Output</p> <ul style="list-style-type: none"> For each test case, output a single line containing an integer representing the maximum possible area for rectangle or -1 if it's impossible to form any rectangle using the available sticks. 	2	5



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	<p>Input</p> <p>2 5 1 2 3 1 2 4 1 2 2 3</p> <p>Output</p> <p>2 -1</p>		
6.	<p>5.1 Implement basic operations (push (), pop () and display ()) of stack using array.</p> <p>5.2 Implement basic operations (push (), pop () and display ()) of stack using linked list.</p>	2	1,2
7.	<p>Chef has a string which contains only the characters '{', '}', '[', ']', '(' and ')'. Now Chef wants to know if the given string is balanced or not. If is balanced then print 1, otherwise print 0.</p> <p>A balanced parenthesis string is defined as follows:</p> <ul style="list-style-type: none"> The empty string is balanced If P is balanced then (P), {P}, [P] is also balanced if P and Q are balanced PQ is also balanced <p>For example "()", "({})[()]" are balanced parenthesis strings while "([{}])", "())" are not balanced.</p> <p>Input</p> <p>The first line of the input contains a single integer T denoting the number of test cases. The description of T test cases follows. The first and only line of each test case contains a single string</p> <p>Output</p> <p>For each test case, print a single line containing the answer.</p> <p>Input:</p> <p>4 () ([)] ({{}})({}) [{}]</p> <p>Output:</p> <p>1 0 1 0</p>	2	5,6
8.	<p>5.1 Implement basic operations (enqueue (), dequeue () and display ()) of queue using array.</p> <p>5.2 Implement basic operations (enqueue (), dequeue () and display ()) of queue using linked list.</p>	2	1,5

	5.3 Implement basic operations (enqueue (), dequeue () and display ()) of circular queue using array.		
9.	<p>Chef has a sequence A_1, A_2, \dots, A_N and an integer K. Now there is a sliding window of size K which is moving from the very left of the array to the very right and at a particular time Chef has access to only those elements that are present in that window and Chef wants to find the number of the distinct elements of each window of size K. Help Chef to find the answer.</p> <p>Input The first line of the input contains a single integer T denoting the number of test cases. The description of T test cases follows. The first line of each test case contains two integers N and K. The second line contains N space-separated integers $A_1, A_2, A_3, \dots, A_N$</p> <p>Output For each test case, print a single line containing space-separated integers — the number of the distinct elements of each window of size from the very left of the array to the very right of the sequence.</p> <p>Example Input 2 6 3 5 8 5 4 4 1 4 2 4 5 2 2</p> <p>Output: 2 3 2 2 2 2 1</p> <p>Explanation: Example case 1: Number of the distinct elements of $[5, 8, 5]$, $[8, 5, 4]$, $[5, 4, 4]$, $[4, 4, 1]$ are respectively 2, 3, 2, 2.</p>	2	4
10.	Implement Binary Search Tree (BST) using following operations. (a) Insert (b) Search (c) Traversal (Inorder, Preorder, Postorder)	4	1,4
11.	Implement a Graph to perform following operations. 11.1 Adjacency list representation 11.2 Apply DFS and BFS on the given graph.	2	2,6
12.	In an array of 20 elements, arrange 15 different values, which are generated randomly between 1,00,000 to 9,99,999. Use hash function to generate key and linear probing to avoid collision. $H(x) = (x \bmod 18) + 2$. Write a program to input and display the final values of array.	2	1,3