**CSA03 - DATA STRUCTURES LIST OF EXPERIMENTS**

1. Given an array of size N-1 such that it only contains distinct integers in the range of 1 to N. Find the missing element.

Input:

N = 5

A[] = {1,2,3,5}

Output: 4

Input:

N = 10

A[] = {6,1,2,8,3,4,7,10,5}

Output: 9

1. Given the root of a binary tree. Check whether it is a BST or not.

Input:

2

/ \

1 3

Output: 1

Input:

2

\

7

\

6

\

5

\

9

\

2

\

6

Output: 0

3) In a class, there are 40 students, monitored by an old professor. During the presentation in the class, the attender came from the office and asked for a student having register number 191911123. Help the professor to search that student at a time complexity of O(log n).

Input : A [40] = { 191811132, … in ascending order}

Output: Yes, the student is found at 15th position.

4) In an array of 10 locations, the age of various students are allotted. Count the odd and even number of students eligible to vote for the forthcoming election.

Input: A[] = { 12, 21, 16,19, 18, 16, 22, 20, 17, 15 }

Output: Odd = 2 Even = 3

5) Generate a series by giving the first variable as 1 and the second variable as 2 using recursion of 8 numbers.

Input : 8

Output: 1 2 3 5 8 13 21 34

6) In a battalion, the soldiers are standing very attentively, obeying the orders of the team leader. The chief guest is watching from the gallery and accepts their salutation from the NCC Battalion. One soldier’s uniform is not properly stitched and it's highly visible to the audience. You adapt a method of linear search and identify where the key element is?.

Input: A[] = { 899, 786, 112, 485, 459, 185, 789, 456, 786, 110}

Key = 786

Output: Found at position 9.

7) Using a pivot element, divide the total array elements into two groups as the left side is smaller than the pivot and the right side is greater than that. Perform the sorting for the given elements.

Input : A [] = { 55, 66, 77, 22, 99, 11, 88, 44, 33, 12}

Output: 11 12 22 33 44 55 66 77 88 99

8) Implement a singly linked list for performing the following operations in Stack. i) Push ii) Pop iii) Peek iv) Display the list.

9) Implement a queue data structure using a Single linked list, by performing the following operations. 1) Enqueue, 2) Dequeue 3) Display

10) You have a stack which is initially empty. You receive instructions of the form 1 or 0. 1 denotes that you have to push in an element, and 0 denotes that you have to pop out an element. But of course you can pop something out only if it exists in the stack. So your job is to look at the instructions and see if they are valid (ie. you never have to pop from an empty stack), or not.

IInput :

The first line of the input contains a single integers T, which denotes the number of testcases.

The first line of each testcase contains a single integer n, which denotes the number of instructions.

The second line contains n space separated integers, which are all 0 or 1.

Output:

For each testcase output either "Valid" or "Invalid", in a new line.

Constraints

1≤ T ≤10

1≤ n ≤ 105

All instructions are either 0 or 1.

**Sample Input**

2

5

1 1 0 0 1

5

1 0 0 1 1

Sample Output

Valid

Invalid

Explanation

Testcase 2: You first push something, and then pop it out. So now you have an empty stack, but the next operation is a Pop, and hence this is Invalid.

11) A bracket is considered to be any one of the following characters: (, ), {, }, [, or ].Two brackets are considered to be a matched pair if the an opening bracket (i.e., (, [, or {) occurs to the left of a closing bracket (i.e., ), ], or }) of the exact same type. There are three types of matched pairs of brackets: [], {}, and ().

A matching pair of brackets is not balanced if the set of brackets it encloses are not matched. For example, {[(])} is not balanced because the contents in between { and } are not balanced. The pair of square brackets encloses a single, unbalanced opening bracket, (, and the pair of parentheses encloses a single, unbalanced closing square bracket, ].

By this logic, we say a sequence of brackets is balanced if the following conditions are met:

It contains no unmatched brackets.

The subset of brackets enclosed within the confines of a matched pair of brackets is also a matched pair of brackets.

Given ***n*** strings of brackets, determine whether each sequence of brackets is balanced. If a string is balanced, return YES. Otherwise, return NO.

Function Description

Complete the function isBalanced in the editor below. It must return a string: YES if the sequence is balanced or NO if it is not.

isBalanced has the following parameter(s):

s: a string of brackets

Input Format

The first line contains a single integer***n*** , the number of strings.

Each of the next ***n*** lines contains a single string ***s***, a sequence of brackets.

**Output Format**

For each string, return YES or NO.

**Sample Input**

3

{[()]}

{[(])}

{{[[(())]]}}

**Sample Output**

YES

NO

YES

12) Convert infix expression into postfix expression using stack as its major application.

Input: (a+b\*c-d) / (e / f \*g) + (h-I)

Output: abc\*+d- ef/g\*/ hI-+

13) Evaluate the postfix expression using stack.

Input: 6 7 3 \* + 2 -

Output : 25

14) Given two arrays A1[] and A2[], sort A1 in such a way that the relative order among the elements will be the same as those in A2. For the elements not present in A2, append them at last in sorted order.

**Sample Input:**

A1[] = {2, 1, 2, 5, 7, 1, 9, 3, 6, 8, 8}

A2[] = {2, 1, 8, 3}

**Sample Output:**

A1[] = {2, 2, 1, 1, 8, 8, 3, 5, 6, 7, 9}

15) Given a list of N array elements, apply Merge sort. Merge Sort is a Divide and Conquer algorithm. It divides input array in two halves, calls itself for the two halves and then merges the two0c sorted halves. The first line contains an integer, N, the number of elements in Array. The second line contains N space-separated integers. Print the array as a row of space-separated integers each iteration

**Sample Input:**

10

10 1 9 2 8 3 4 7 5 6

**Sample Output:**

1 10

1 9 10

2 8

1 2 8 9 10

3 4

3 4 7

5 6

3 4 5 6 7

1 2 3 4 5 6 7 8 9 10

16) The collision in the hashing will be resolved by separated chaining using a single linked list, in which address is maintained in the hash table. For the following keys, map the keys into the hash table of size of 6. The keys are 22, 56, 89, 34, 54, 67, 42, 36, 98, 28.

17) Finding the difference between maximum and minimum number is a comedy game for Tom. Help him with your coding as samples given beow.

Sample input: 7

22 45 78 12 89 34 27

Sample Output 77

18) Perform a matrix multiplication using the following A x B Matrix of size n & m and m & k, so that the output C matrix will be the size of n&k.

3

Input : [ 1 2 1 ] x [ 2 ]

2

Output : 9

19)Given a Binary Tree, print Left view of it. Left view of a Binary Tree is set of nodes visible when the tree is visited from the Left side. The task is to complete the function leftView(), which accepts the root of the tree as an argument.

Left view of the following tree is 1 2 4 8.

1

/ \

2 3

/ \ / \

4 5 6 7

\

8

Example 1:

Input:

1

/ \

3 2

Output: 1 3

20)Given a sorted array of size N and an integer K, find the position at which K is present in the array using binary search.

Example 1:

Input:

N = 5

arr[] = {1 2 3 4 5}

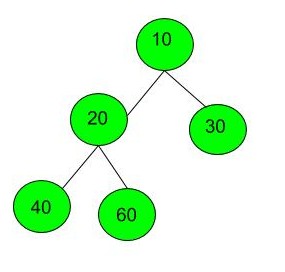
K = 4

Output: 3

Explanation: 4 appears at index 3.

Example 2:

Input:



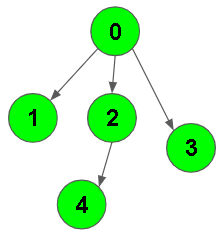
Output: 10 20 40

Given a directed graph. The task is to do Breadth First Traversal of this graph starting from 0.

Note: One can move from node u to node v only if there's an edge from u to v and find the BFS traversal of the graph starting from the 0th vertex, from left to right according to the graph. Also, you should only take nodes directly or indirectly connected from Node 0 in consideration.

Example 1:

Input:



Output: 0 1 2 3 4

Explanation:

0 is connected to 1 , 2 , 3.

2 is connected to 4.

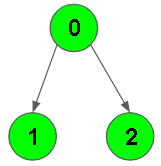
so starting from 0, it will go to 1 then 2

then 3.After this 2 to 4, thus bfs will be

0 1 2 3 4.

Example 2:

Input:



Output: 0 1 2

Explanation:

0 is connected to 1 , 2.

so starting from 0, it will go to 1 then 2,

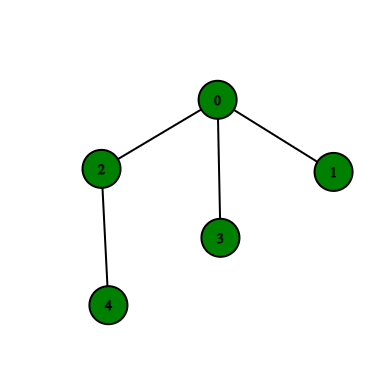
thus bfs will be 0 1 2.

21)You are given a connected undirected graph. Perform a Depth First Traversal of the graph.

Note: Use a recursive approach to find the DFS traversal of the graph starting from the 0th vertex from left to right according to the graph.

Example 1:

Input: V = 5 , adj = [[2,3,1] , [0], [0,4], [0], [2]]



Output: 0 2 4 3 1

Explanation:

0 is connected to 2, 3, 1.

1 is connected to 0.

2 is connected to 0 and 4.

3 is connected to 0.

4 is connected to 2.

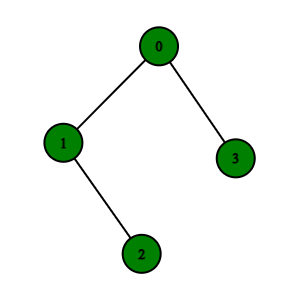
so starting from 0, it will go to 2 then 4,

and then 3 and 1.

Thus dfs will be 0 2 4 3 1.

Example 2:

Input: V = 4, adj = [[1,3], [2,0], [1], [0]]



Output: 0 1 2 3

Explanation:

0 is connected to 1 , 3.

1 is connected to 0, 2.

2 is connected to 1.

3 is connected to 0.

so starting from 0, it will go to 1 then 2

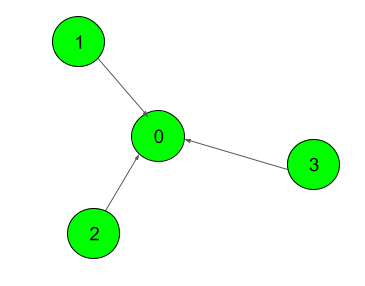
then back to 0 then 0 to 3

thus dfs will be 0 1 2 3.

22)Given a Directed Acyclic Graph (DAG) with V vertices and E edges, Find any Topological Sorting of that Graph.

Example 1:

Input:



Output:

1

Explanation:

The output 1 denotes that the order is

valid. So, if you have, implemented

your function correctly, then output

would be 1 for all test cases.

One possible Topological order for the

graph is 3, 2, 1, 0.

Given a Binary Tree, find the In-Order Traversal of it.

Example 1:

Input:

1

/ \

3 2

Output: 3 1 2

Example 2:

Input:

10

/ \

20 30

/ \ /

40 60 50

Output: 40 20 60 10 50 30

23.Write a program to implement a Stack using Array. Your task is to use the the functions push() and pop() to implement a stack.

Example 1:

Input:

push(2)

push(3)

pop()

push(4)

pop()

Output: 3, 4

Explanation:

push(2) the stack will be {2}

push(3) the stack will be {2 3}

pop() poped element will be 3,

the stack will be {2}

push(4) the stack will be {2 4}

pop() poped element will be 4

Example 2:

Input:

pop()

push(4)

push(5)

pop()

Output: -1, 5

Implement a Queue using 2 stacks s1 and s2 .

24.A Query Q is of 2 Types

(i) 1 x (a query of this type means pushing 'x' into the queue)

(ii) 2 (a query of this type means to pop element from queue and print the poped element)

Example 1:

Input:

5

1 2 1 3 2 1 4 2

Output:

2 3

25.Implement a Stack using two queues q1 and q2.

Example 1:

Input:

push(2)

push(3)

pop()

push(4)

pop()

Output: 3 4

Explanation:

push(2) the stack will be {2}

push(3) the stack will be {2 3}

pop() poped element will be 3 the

stack will be {2}

push(4) the stack will be {2 4}

pop() poped element will be 4

Example 2:

Input:

push(2)

pop()

pop()

push(3)

Output: 2 -1

26.Given a linked list. Print all the elements of the linked list.

Example 1:

Input:

N=2

LinkedList={1 , 2}

Output:

1 2

27.Given a Binary Search Tree. The task is to find the minimum element in this given BST.

Example 1:

Input:

5

/ \

4 6

/ \

3 7

/

1

Output: 1

28.Given 2 Arrays of Inorder and preorder traversal. The tree can contain duplicate elements. Construct a tree and print the Postorder traversal.

Example 1:

Input:

N = 4

inorder[] = {1 6 8 7}

preorder[] = {1 6 7 8}

Output: 8 7 6 1

Example 2:

Input:

N = 6

inorder[] = {3 1 4 0 5 2}

preorder[] = {0 1 3 4 2 5}

Output: 3 4 1 5 2 0

Explanation: The tree will look like

0

/ \

1 2

/ \ /

3 4 5

29. Given a weighted, undirected and connected graph of V vertices and an adjacency list adj where adj[i] is a list of lists containing two integers where the first integer of each list j denotes there is edge between i and j , second integers corresponds to the weight of that edge . You are given the source vertex S and You to Find the shortest distance of all the vertex's from the source vertex S. You have to return a list of integers denoting shortest distance between each node and Source vertex S.

Example 1:

Input:

V = 2

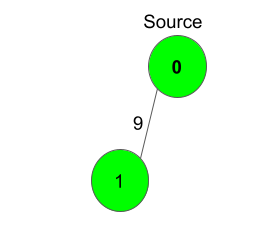
adj [] = {{{1, 9}}, {{0, 9}}}

S = 0

Output:

0 9

Explanation:



The source vertex is 0. Hence, the shortest

distance of node 0 is 0 and the shortest

distance from node 1 is 9.

Example 2:

Input:

V = 3, E = 3

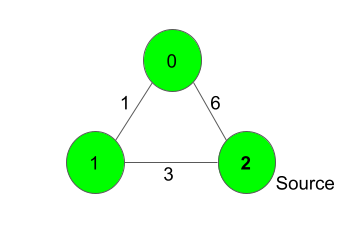
adj = {{{1, 1}, {2, 6}}, {{2, 3}, {0, 1}}, {{1, 3}, {0, 6}}}

S = 2

Output:

4 3 0

Explanation:



For nodes 2 to 0, we can follow the path-

2-1-0. This has a distance of 1+3 = 4,

whereas the path 2-0 has a distance of 6. So,

the Shortest path from 2 to 0 is 4.

The shortest distance from 0 to 1 is 1 .

30. Given a Binary search tree. Your task is to complete the function which will return the Kth largest element without doing any modification in Binary Search Tree.

Example 1:

Input:

4

/ \

2 9

k = 2

Output: 4

Example 2:

Input:

9

\

10

K = 1

Output: 10

31.Implement a Queue using an Array. Queries in the Queue are of the following type:

(i) 1 x (a query of this type means pushing 'x' into the queue)

(ii) 2 (a query of this type means to pop element from queue and print the poped element)

Example 1:

Input:

Q = 5

Queries = 1 2 1 3 2 1 4 2

Output: 2 3

Explanation:

In the first test case for query

1 2 the queue will be {2}

1 3 the queue will be {2 3}

2 poped element will be 2 the

queue will be {3}

1 4 the queue will be {3 4}

2 poped element will be 3

Example 2:

Input:

Q = 4

Queries = 1 3 2 2 1 4

Output: 3 -1

Explanation:

In the second testcase for query

1 3 the queue will be {3}

2 poped element will be 3 the

queue will be empty

2 there is no element in the

queue and hence -1

1 4 the queue will be {4}.

32.Given a Binary Search Tree and a node value X. Delete the node with the given value X from the BST. If no node with value x exists, then do not make any change.

Example 1:

Input:

2

/ \

1 3

X = 12

Output: 1 2 3

Explanation: In the given input there

is no node with value 12 , so the tree

will remain same.

Example 2:

Input:

1

\

2

\

8

/ \

5 11

/ \ / \

4 7 9 12

X = 9

Output: 1 2 4 5 7 8 11 12

Explanation: In the given input tree after

deleting 9 will be

1

\

2

\

8

/ \

5 11

/ \ \

4 7 12

33. .You are given the pointer to the head node of a linked list and an integer to add to the list. Create a new node with the given integer. Insert this node at the tail of the linked list and return the head node of the linked list formed after inserting this new node. The given head pointer may be null, meaning that the initial list is empty.

SAMPLE OUPUT

141

302

164

530

474

34.Given the pointer to the head node of a linked list and an integer to insert at a certain position, create a new node with the given integer as its data attribute, insert this node at the desired position and return the head node.

A position of 0 indicates head, a position of 1 indicates one node away from the head and so on. The head pointer given may be null meaning that the initial list is empty

**Sample Input**

3

16

13

7

1

2

**Sample Output**

16 13 1 7

3.Chef has a string S*S* with him. Chef is happy if the string contains a **contiguous substring** of length **strictly greater** than 22 in which all its characters are vowels.

Determine whether Chef is happy or not.

Note that, in english alphabet, vowels are a, e, i, o, and u.

**Sample input:**

4

aeiou

abxy

aebcdefghij

abcdeeafg

**sample output**

Happy

Sad

Sad

Happy

35.Alice and Bob are meeting after a long time. As usual they love to play some math games. This times Alice takes the call and decides the game. The game is very simple, Alice says out an integer and Bob has to say whether the number is prime or not. Bob as usual knows the logic but since Alice doesn't give Bob much time to think, so Bob decides to write a computer program.

Help Bob accomplish this task by writing a computer program which will calculate whether the number is prime or not

**Sample Input**

5

23

13

20

1000

99991

**Output**

yes

yes

no

no

yes

**36.**.Given the list of numbers, you are to sort them in non decreasing order.

**Sample :**

**Input:**

**5**

**5**

**3**

**6**

**7**

**1**

**Output:**

**1**

**3**

**5**

**6**

**7**

37.You are given a tree of N nodes and N−1 edges. Now you need to select two nodes a and b in the tree such that the cycle that will be formed after adding an edge between the two nodes a and b, its length should be maximum. If there are more than one possible answers, you can output any of them.

**Sample Input**

7

1 2

1 3

2 4

2 5

3 6

3 7

**Sample Output**

4 6

38.You are given the pointer to the head node of a linked list and an integer to add to the list. Create a new node with the given integer. Insert this node at the tail of the linked list and return the head node of the linked list formed after inserting this new node. The given head pointer may be null, meaning that the initial list is empty.

**Sample Output**

141

302

164

530

474

the list is 141 -> 302 -> 164 -> 530 -> 474 -> NULL, which is the final list.

39.Delete the node at a given position in a linked list and return a reference to the head node. The head is at position 0. The list may be empty after you delete the node. In that case, return a null value.

**Sample Input**

8

20

6

2

19

7

4

15

9

3

**Sample Output**

20 6 2 7 4 15 9

40.Given a pointer to the head of a linked list, insert a new node before the head. The *next* value in the new node should point to *head* and the *data* value should be replaced with a given value. Return a reference to the new head of the list. The head pointer given may be null meaning that the initial list is empty.

**Sample Input**

5

383

484

392

975

321

**Sample Output**

321

975

392

484

383

41.A bracket is considered to be any one of the following characters: (, ), {, }, [, or ].

Two brackets are considered to be a matched pair if the opening bracket (i.e., (, [, or {) occurs to the left of a closing bracket (i.e., ), ], or }) of the exact same type. There are three types of matched pairs of brackets: [], {}, and ().

**Sample Input**

STDIN Function

----- --------

3 n = 3

{[()]} first s = '{[()]}'

{[(])} second s = '{[(])}'

{{[[(())]]}} third s ='{{[[(())]]}}'

**Sample Output**

YES

NO

YES

42.Given a pointer to the head of a linked list and a specific position, determine the data value at that position. Count backwards from the tail node. The tail is at postion 0, its parent is at 1 and so on.

**Sample Input**

2

1

1

0

3

3

2

1

2

**Sample Output**

1

3

43.In this challenge, you are required to implement inorder traversal of a tree.

Complete the ***inorder*** function in your editor below, which has a parameter: a pointer to the root of a binary tree. It must print the values in the tree's inorder traversal as a single line of space-separated values.

**Sample Input**

1

\

2

\

5

/ \

3 6

\

4

**Sample Output**

1 2 3 4 5 6

44. Complete the *POSTORDER* function in the editor below. It received a parameter: a pointer to the root of a binary tree. It must print the values in the tree's postorder traversal as a single line of space-separated values.

**Sample Input**

1

\

2

\

5

/ \

3 6

\

4

**Sample Output**

4 3 6 5 2 1

14. You are given a linked list that contains N integers. You have performed the following reverse operation on the list:

* Select all the subparts of the list that contain only even integers. For example, if the list is {1,2,8,9,12,16}, then the selected subparts will be {2,8}, {12,16}.
* Reverse the selected subpart such as {8,2} and {16,12}.

Now, you are required to retrieve the original list.

**Note**: You should use the following definition of the linked list for this problem:

class Node {

Object data;

Node next;

}

**Sample Input**

9

2 18 24 3 5 7 9 6 12

**Sample Output**

24 18 2 3 5 7 9 12 6

45.. Given the pointer to the head node of a doubly linked list, reverse the order of the nodes in place. That is, change the next and prev pointers of the nodes so that the direction of the list is reversed. Return a reference to the head node of the reversed list.

**Note:** The head node might be NULL to indicate that the list is empty.

**Sample Input**

1

4

1

2

3

4

**Sample Output**

4 3 2 1

46.. You are given a pointer to the root of a binary search tree and values to be inserted into the tree. Insert the values into their appropriate position in the binary search tree and return the root of the updated binary tree. You just have to complete the function.

**Sample Input**

4

/ \

2 7

/ \

1 3

**Sample Input**

4

/ \

2 7

/ \

1 3

47.. Given an array arr[], its starting position l and its ending position r. Sort the array using merge sort algorithm.

**Input:**

N = 5

arr[] = {4 1 3 9 7}

**Output:**

1 3 4 7 9

48.. The task is to complete the **insert()** function which is used to implement Insertion Sort.

**Input:**

N = 5

arr[] = {5 1 3 9 7}

**Output:**

1 3 5 7 9

49. Given a random set of numbers, Print them in sorted order.

Input:

N = 4

arr[] = {1, 5, 3, 2}

Output: {1, 2, 3, 5}

Explanation: After sorting array will

be like {1, 2, 3, 5}.

50. Given two sorted linked lists consisting of **N and M** nodes respectively. The task is to merge both of the list (in-place) and return head of the merged list.

**Input:**

N = 4, M = 3

valueN[] = {5,10,15,40}

valueM[] = {2,3,20}

**Output:** 2 3 5 10 15 20 40

Explanation: After merging the two linked

lists, we have merged list as 2, 3, 5,

10, 15, 20, 40.