DSA Practice Problems For ET

(by bharat)

Q1. Detect cycle in a directed graph

Given a Directed Graph with V vertices (Numbered from 0 to V-1) and E edges, check whether it contains any cycle or not.

Input:
First line contains two integers V and E which represent the number of vertex and number of edges in directed graph respectively.

Next all lines contains two integers v1 and v2which represent the two vertex and edge between it.
Output:
Print true or false (graph has cycle or not)

Example test case:

Input	Output
5 5 1 2 2 3 3 1 1 4 2 0	true

Q2. Number of Islands

Given an m x n 2D binary grid grid which represents a map of '1's (land) and '0's (water), return the number of islands.

An island is surrounded by water and is formed by connecting adjacent lands horizontally or vertically. You may assume all four edges of the grid are all surrounded by water.

Input:

First line contains two integers m and n which represent the number of rows and number of columns in 2D binary grid respectively.

Next all lines contains all elements of matrix.

Output:

Print integer which represent the number of islands in 2D grid

Example test case:

Input	Output
5 5 1 0 1 0 1 1 1 0 1 1 1 0 0 0 1 0 1 1 1 0 0 0 1 0 0	4

Q3. check graph is bipartite

There is an undirected graph with n nodes, where each node is numbered between 0 and n - 1. You are given a 2D array graph, where graph[u] is an array of nodes that node u is adjacent to. More formally, for each v in graph[u], there is an undirected edge between node u and node v. The graph has the following properties:

- ➔ There are no self-edges (graph[u] does not contain u).
- ➔ There are no parallel edges (graph[u] does not contain duplicate values).
- ➔ If v is in graph[u], then u is in graph[v] (the graph is undirected).
- ➔ The graph may not be connected, meaning there may be two nodes u and v such that there is no path between them.

A graph is bipartite if the nodes can be partitioned into two independent sets A and B such that every edge in the graph connects a node in set A and a node in set B.

Input:
First line contains two integers V and E which represent the number of vertex and number of edges in directed graph respectively.

Next all lines contains two integers v1 and v2 which represent the two vertex and edge between it.
Output:
print true or false (graph is bipartite or not)

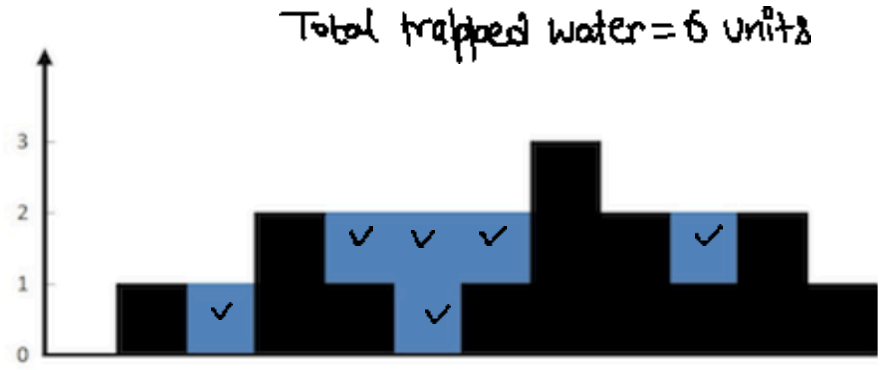
Example test case:

Input	Output
5 5 0 2 2 4 4 3 3 1 0 3	true

Q4. Trapping rain water

Given N non-negative integers representing an elevation map where the width of each bar is 1, compute how much water it can trap after raining.

Example 1:



Input:
First line contains a integer N represents the length of array.
Second line contains all N elements of array

Output:
Print total water trapped inside array

Constraints:
1<=N<=2x10^4;

Example test case:

Input	Output
11 1 0 2 1 0 1 3 2 1 2 1	6
7 1 5 0 3 6 2 1	7

Q5. Find next greater element

We are given a circular array, print the next greater number for every element. If it is not found print -1 for that number. To find the next greater number for element A_i , start from index i + 1 and go uptil the last index after which we start looking for the greater number from the starting index of the array since array is circular.

Input:

First line contains the length of the array n. Second line contains the n space separated integers.

Output:

Print n space separated integers each representing the next greater element.

Example:

Input: 3
1 2 3

Output: 2 3 -1

Q6. ADD TWO NUMBERS

You are given two non-empty linked lists representing two non-negative integers. The digits are stored in reverse order, and each of their nodes contains a single digit. Add the two numbers and return the sum as a linked list.

You may assume the two numbers do not contain any leading zero, except the number 0 itself.

Input:

First line contains length of both linked list n1 and n2.

Second line contains the all n1 elements present in linked list 1

Third line contains the all n2 elements present in linked list 1

Output:

All elements of final linked which contains sum.

Example test case:

Input	Output
3 3 6 3 2 4 8	0 2 3

Q7. Nearly sorted array

Given an array of **N** elements, where each element is at most K away from its target position, devise an algorithm that sorts in O(N log K) time.

Input:
First line contains length of array n and k which represent the how much the array element away from its target position.
Second line contains the all n elements present in array
Output:
All elements of sorted array.
Example test case:

Input	Output
6 3 2 6 3 12 56 8	2 3 6 8 12 56

Q8. Nth Ugly Number

An ugly number is a positive integer whose prime factors are limited to 2, 3, and 5. Given an integer N, return the nth ugly number.

Example: for 10^{th} ugly number [1, 2, 3, 4, 5, 6, 8, 9, 10, 12] is the sequence of the first 10 ugly numbers so the 10^{th} ugly number will be 12.

Input:
First line contains a integer N.
Output:

Print the Nth Ugly Number

Constraints:
1<=N<=1690

Example test case:

Input	Output
10	12
104	1800

Q9. Find Maximum Height of binary Tree

A binary tree's maximum height is the number of nodes along the longest path from the root node down to the farthest leaf node.

Input:
First line contains value all Nodes of Tree
Note: all -1 input denotes NULL node

Output:
Return An integer which determine maximum height

Example test case:

Input	Output
1 2 3 4 6 -1 5 -1 -1 7 -1 -1 -1 -1 -1	4

Q10. Check whether tree is balanced binary tree.

A height-balanced binary tree is a binary tree in which the depth of the two subtrees of every node never differs by more than one.

Input:

First line contains value all Nodes of Tree

Note: all -1 input denotes NULL node

Output:

Return true or false for balanced binary tree

Example test case:

Input	Output
5 6 7 3 -1 9 -1 -1 10 -1 -1 2 -1 -1 -1	false

Q11. Sum Root to Leaf Numbers

You are given the root of a binary tree containing digits from 0 to 9 only.
Each root-to-leaf path in the tree represents a number.

For example, the root-to-leaf path 1 -> 2 -> 3 represents the number 123.

A leaf node is a node with no children.

Input:

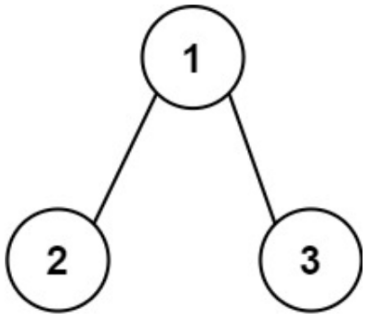
First line contains value all Nodes of Tree

Note: all -1 input denotes NULL node

Output:

Return the total sum of all root-to-leaf numbers. Test cases are generated so that the answer will fit in a 32-bit integer.

Example test case:



Input	Output
1 2 3 -1 -1 -1 -1	25

Q12. Lowest Common Ancestor in Binary Tree

Given a binary tree, find the lowest common ancestor (LCA) of two given nodes in the tree.

The lowest common ancestor is defined between two nodes p and q as the lowest node in T that has both p and q as descendants (where we allow a node to be a descendant of itself).

Input:

First line contains value all Nodes of Tree

Note: all -1 input denotes NULL node

Second line contains two integers which represents the value of two nodes p and q respectively

Output:

Return the value of lowest common ancestor of p and q node

Example test case:

Input	Output
1 2 3 -1 -1 4 5 -1 -1 -1 -1 4 5	3

Q13. Construct a Balanced Binary search Tree from sorted array

Given an sorted array you need construct a balanced binary tree using every element of array

Balanced binary tree: difference between left and right sub tree must be less than or equal to 1

Input:

First line contains a integer N which denotes the size of input sorted array

Second line contains all element of array

Output:

Return the level order traversal of constructed binary search tree

Example test case:

Input	Output
5 1 2 3 4 5	3 1 4 2 5

Q14 Kth Element form last Linked List

Given a linked list with n nodes. Find the k^{th} element from last without computing the length of the linked list.

Input Format

First line contains space separated integers representing the node values of the linked list. The list ends when the input comes as '-1'. The next line contains a single integer k.

Constraints

`n < 10^5`

Output Format

Output a single line containing the node value at the kth element from last.

Example:

Sample Input

```
1 2 3 4 5 6 -1
3
```

Sample Output

```
4
```

Note: The linked list is 1 2 3 4 5 6. -1 is not included in the list. So the third element from the last is 4

Q15. Triplet From LinkedList

Given three linked lists, say a, b and c, find one node from each list such that the sum of the values of the nodes is equal to a given number say, Target. As any number of answers can be possible

return the first one you get while traversing.

Input Format

The First Line contains 3 Integers n, m and k as the Size of the Three LinedLists. Next 3 Lines contains n, m and k integers Respectively as the elements of Linked Lists. Next Line contains the an Integer as Target.

Constraints

The Size of the Lists can be different.

Output Format

Display the 3 elements from each of the Lists whose sum is equals to the target separated by space.

Sample Input

```
3 3 3
12 6 29
23 5 8
90 20 59
101
```

Sample Output

```
6 5 90
```

Explanation

In the Given Sample Input, 6, 5 and 90 from lists 1, 2 and 3 respectively add to give 101.

Q16. Maximum Length of a Concatenated String with Unique Characters

Description:

You are given an array of strings arr. A string s is formed by the concatenation of a subsequence of arr that has unique characters.

Return the maximum possible length of s.

A subsequence is an array that can be derived from another array by deleting some or no elements without changing the order of the remaining elements.

INPUT:

First line contains a integer n which represent the size of vector of string

Second line contains all strings of vector

OUTPUT:

First line contains the length of largest string that can be form

Example Test case:

INPUT	OUTPUT
3 un iq ue	4

Explanation: All the valid concatenations are:
- ""
- "un"
- "iq"
- "ue"
- "uniq" ("un" + "iq")
- "ique" ("iq" + "ue")

Maximum length is 4.

Constraints : n=size of vector of string
1<=n<=16
s[i] is string in vector of string
1<=s[i]<=26

Q17. Rat in a maze

Description

Consider a rat placed at (0, 0) in a square matrix of order N * N. It has to reach the destination at (N – 1, N – 1). Find all possible paths that the rat can take to reach from source to destination. The directions in which the rat can move are ‘D'(down), ‘R’ (right), ‘L’ (left), ‘U’(up). Value 0 at a cell in the matrix represents that it is blocked and rat cannot move to it while value 1 at a cell in the matrix represents that rat can be travel through it. Return the list of paths in lexicographically increasing order.
Note: In a path, no cell can be visited more than one time. If the source cell is 0, the rat cannot move to any other cell.

INPUT:

First line contains a integer n which represent the number of column and rows in 2D vector

Second line contains all elements of 2D vector

OUTPUT:

First line contains all the paths that can be possible

Example Test case:

INPUT	OUTPUT
3 1 1 0 1 1 0 1 1 1	DDRR DRDR RDDR RDLDRR

Constraints : n=size of column and row

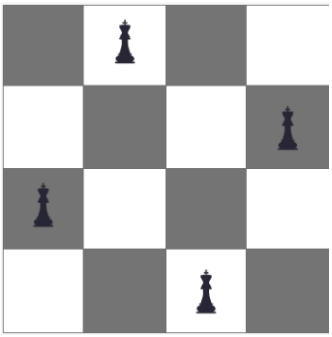
1<n<=10

Q18. N Queen Problem

Description:

The N Queen is the problem of placing N chess queens on an N×N chessboard so that no two queens attack each other.

For example, the following is a solution for the 4 Queen problem.



The expected output is in the form of a matrix that has ‘Q‘s for the blocks where queens are placed and the empty spaces are represented by ‘.’ . For example, the following is the output matrix for the above 4-Queen solution.

INPUT:

First line contains a integer n which represent the number of column and rows in 2D vector

OUTPUT:

First line contains all possible n queen matrix

Example Test case:

INPUT	OUTPUT
4	. Q . . . . . Q Q . . . . . Q . . . Q . Q . . . . . . Q . Q . .

Constraints : n=size of column and row
1<n<=10

Q19. Write a recursive function which prints subsequences of the array which sum to target.

Input Format

Take an input N, a number. Take N more inputs and store that in an array. Take an input target (a number).

Output Format

print the subsets in separate lines.

Constraints

0 < N < 100

Input	Output
3 1 2 3	3 1 2

3	

Explanation
The sum of all elements in the subsets {3} and {1,2} equals 3.

Q20 .Given an integer 'n'. Print all the possible pairs of 'n' balanced parentheses.
The output strings should be printed in the sorted order considering '(' has higher value than ')'.

Input Format
Single line containing an integral value 'n'.

Output Format
Print the balanced parentheses strings with every possible solution on a new line.

Input	Output
2	()() (())

Q21.Take as input N, the size of the array. Take N more inputs and store that in an array. Take as input M, a number. Write a recursive function which returns the last index at which M is found in the array and -1 if M is not found anywhere. Print the value returned.

Input Format
Enter a number N and add N more numbers to an array, then enter number M to be searched

Output Format
Display the last index at which the number M is found

Sample input:

Input	Output
5 3 2 1 2 3	3

2	

22. Given an integer N, now you have to convert all zeros of N to 5.
Input Format
The first Line takes input integer N, denoting the number.

Output Format
Print the number after replacing all 0's with 5.

Sample test case:

Input	Output
103	153

Test cases:

Input	Output
103	153
10090	15595
100	155
19901	19951
50505050	55555555

Q23.Take as input **N**, a number. Print *odd* numbers in decreasing sequence (up until 0) and *even* numbers in increasing sequence (up until N) using Recursion

Input Format
Take as input **N**

Output Format
Print *odd* numbers in decreasing sequence (up until 0) and *even* numbers in increasing sequence (up until N)

Sample test case:

Input	Output
5	5 3 1 2 4

24.You are given an N*M grid. Each cell (i,j) in the grid is either blocked, or empty. The rat can move from a position towards left, right, up or down on the grid.
Initially rat is on the position (1,1). It wants to reach position (N,M) where it's cheese is waiting for. If a path exists-it is always unique. Find that path and help the rat reach its cheese.

Input Format
First line contains 2 integers N and M denoting the rows and columns in the grid.
Next N line contains M characters each. An 'X' in position (i,j) denotes that the cell is blocked and ans 'O' denotes that the cell is empty.

Output Format
Print N lines, containing M integers each. A 1 at a position (i,j) denotes that the (i,j)th cell is covered in the path and a 0 denotes that the cell is not covered in the path.
If a path does not exists then print "NO PATH FOUND"

Sample test case:

Input	Output
5 4 OXOO OOOX XOXO XOOX XXOO	1 0 0 0 1 1 0 0 0 1 0 0 0 1 1 0 0 0 1 1

Q23.Given a boolean matrix mat[M][N] of size M X N, modify it such that if a matrix cell mat[i][j] is 1 (or true) then make all the cells of ith row and jth column as 1.

Input Format
First line contains two integers m and n denoting the dimensions of the matrix Next m lines contain n integers each.

Output Format
Print the modified matrix

Input	Output
2 2 1 0 0 0	1 1 1 0

24.Given an n x m matrix, where every row and column is sorted in increasing order, and a number x . Find if element x is present in the matrix or not.

Input Format
First line consists of two space separated integers N and M, denoting the number of element in a row and column respectively. Second line of each test case consists of N*M space separated integers denoting the elements in the matrix in row major order. Third line of each test case contains a single integer x, the element to be searched.

Output Format
Print 1 if the element is present in the matrix, else 0.

Sample Test Case:

Input	Output
3 3 3 30 38 44 52 54 57 60 69 62	0

Explanation
Search the element in the sorted matrix. If the element is present print 1 otherwise print 0. In the sample input,in first case 62 is not present in the matrix so 0 is printed. Similarly, for second case 55 is present in the matrix so 1 is printed.

Q25. Given a N*N matrix. The task is to find the index of column with maximum sum. That is the column whose sum of elements are maximum.
Input Format

First line contains the N ,size of the square matrix. Next N lines contains N integers each denoting the elements of the matrix

Output Format
Print N lines each containing N elements. These are the elements of the new matrix.

Sample Input

Input	Output
7 90 40 1 3 39 59 90 48 72 67 32 73 19 27 22 37 47 68 1 5 55 81 5 39 53 38 86 21 1 32 7 44 2 65 47 68 13 24 28 69 81 43 16 34 67 3 82 26 35	6 341

Explanation:
6th column has the highest sum that is 341.

26 .Given a 2D array of size N x N. Rotate the array 90 degrees anti-clockwise.

Input Format
First line contains a single integer N. Next N lines contain N space separated integers.

Output Format
Print N lines with N space separated integers of the rotated array.

Sample test case:

Input	Output
4 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	4 8 12 16 3 7 11 15 2 6 10 14 1 5 9 13

Q27.Take an input N, a number. Take N more inputs and store that in an array. Take an input target, a number

a. Write a recursive function which prints subsets of the array which sum to target.

b. Write a recursive function which counts the number of subsets of the array which sum to target. Print the value returned.

Input Format
Take an input N, a number. Take N more inputs and store that in an array. Take an input target, a number

Output Format
Display the number of subsets and print the subsets in a space separated manner.

Input	Output
3 1 2 3 3	1 2 3 2

Q28.Take as input S, a string. Write a function that toggles the case of all characters in the string. Print the value returned.

Input Format
String

Output Format:
String

Sample Input:

Input	Output
abC	ABc

Explanation
Toggle Case means to change UpperCase character to LowerCase character and vice-versa.

Q29.Take as input S, a string. Write a function that replaces every even character with the character having just higher ASCII code and every odd character with the character having just lower ASCII code. Print the value returned.

Input Format
String

Output Format
String

Sample Test Case:

Input	Output
abcg	badf

Q30.Take as input S, a string. Write a function that returns true if the string is a palindrome and false otherwise. Print the value returned.
Input Format
String

Output Format
Boolean

Sample input:

Input	Output
abba	true

Explanation
A string is said to be palindrome if reverse of the string is same as string. For example, “abba” is palindrome as it's reverse is "abba", but “abbc” is not palindrome as it's reverse is "cbba".

31.Take as input S, a string. Write a function that returns the character with maximum frequency. Print the value returned.

Input Format

String

Output Format
Character

Sample Input

Input	Output
aaabacb	a

Explanation
For the given input string, a appear 4 times. Hence, it is the most frequent character.

Q32.Take as input a 2-d array. Print the 2-D array in spiral form anti-clockwise.

Input Format
Two integers M(row) and N(column) and further M * N integers(2-d array numbers).

Output Format
All M * N integers separated by commas with 'END' written in the end(as shown in example).

Sample Input

Input	Output
4 4 11 12 13 14 21 22 23 24 31 32 33 34 41 42 43 44	11, 21, 31, 41, 42, 43, 44, 34, 24, 14, 13, 12, 22, 32, 33, 23, END

Explanation
For spiral level anti-clockwise traversal, Go for first column-> last row ->last column-> first row and then do the same traversal for the remaining matrix .

Q33. Unique Paths

There is a robot on an m x n grid. The robot is initially located at the top-left corner (i.e., grid[0][0]).
The robot tries to move to the bottom-right corner (i.e., grid[m - 1][n - 1]). The robot can only move either down or right at any point in time.

Given the two integers m and n, return the number of possible unique paths that the robot can take to reach the bottom-right corner.

Input Format
Two integers M(row) and N(column).

Output Format
Print the total number of unique paths can be formed

Sample Input

Input	Output
4 5	35

Constraints : m=size of row, n= size of column
1<m,n<=600

The test cases are generated so that the answer will be less than or equal to 2 * 10^9

34. Heapy the array

You are given an array , your task is to rearrange the whole array so it can form a max heap order

Input Format
First line contains an Integer N which represents the size of array.

Second line contains all the N elements of the array

Output Format
Print the max heap order of the array .

Sample Input

Input	Output
8 2 4 1 7 10 9 5 3	10 7 9 3 4 1 5 2

Constraints : m=size of row, n= size of column

1<m,n<=600

Explanation: when all the parent node are greater than its children then the CBT is max heap

35. Coin change

You are given an integer array coins representing coins of different denominations and an integer amount representing a total amount of money.

You may assume that you have an infinite number of each kind of coin.

Input Format

First line contains Two Integers ‘N’ which represents the size of coins array and ‘Amount’ which represents the total money you need to make .

Second line contains all the N elements of the coins array

Output Format

Print the fewest number of coins that you need to make up that amount. If that amount of money cannot be made up by any combination of the coins, Print -1.

Sample Input

Input	Output
4 12 2 3 5 1	3

Constraints : N=Coins array size, Amount= total sum

1<=N<=12

1<=Amount<=1000

36. House robber

You are a professional robber planning to rob houses along a street. Each house has a certain amount of money stashed, the only constraint stopping you from robbing each of them is that adjacent houses have security systems connected and it will automatically contact the police if two adjacent houses were broken into on the same night.

Given an integer array nums representing the amount of money of each house,

Input Format

First line contains a Integers ‘N’ which represents the size of house array.

Second line contains all the N elements of the house array

Output Format

Print the maximum amount of money you can rob tonight without alerting the police

Sample Input

Input	Output
5 1 4 2 3 5	9

Constraints : N=house array size
1<=N<=100

37. Nth Fibonacci

Given a number n, print n-th Fibonacci Number.
Nth term= (N-1)th term + (N-2)th term

Note : As the answer might be large, return the final answer modulo 10^9 + 7

Input Format

First line contains a Integers ‘N’.

Output Format

Print Nth Fibonacci Number

Sample Input

Input	Output
	9

Constraints : N=term number you need to find
1<=N<=10000

38. Jump game

You are given an integer array nums. You are initially positioned at the array's first index, and each element in the array represents your maximum jump length at that position.

Input Format

First line contains a Integers ‘N’ which represents the size of nums array.

Second line contains all the N elements of the nums array

Output Format

Print true if you can reach the last index, or false otherwise.

Sample Input

Input	Output
5 2 3 1 1 4	true

Constraints : N=size of nums array
1<=N<=10000