Experiment 8

Competitive Coding Lab (Dynamic Programming)

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PROBLEM STATEMENT 8.1: -

https://www.hackerrank.com/challenges/construct-the-array/problem?isFullScreen=false

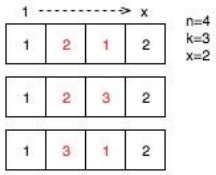
Problem | Submissions | Leaderboard | Discussions | Editorial

Your goal is to find the number of ways to construct an array such that consecutive positions contain different values.

Specifically, we want to construct an array with n elements such that each element between 1 and k, inclusive. We also want the first and last elements of the array to be 1 and x.

Given n, k and x, find the number of ways to construct such an array. Since the answer may be large, only find it modulo $10^9 + 7$.

For example, for $n = 4$, $k = 3$, $x = 2$, there are 3 ways, as shown here:



Complete the function `countArray` which takes input n, k and x. Return the number of ways to construct the array such that consecutive elements are distinct.

Constraints

- $3 \leq n \leq 10^5$
- $2 \leq k \leq 10^5$
- $1 \leq x \leq k$

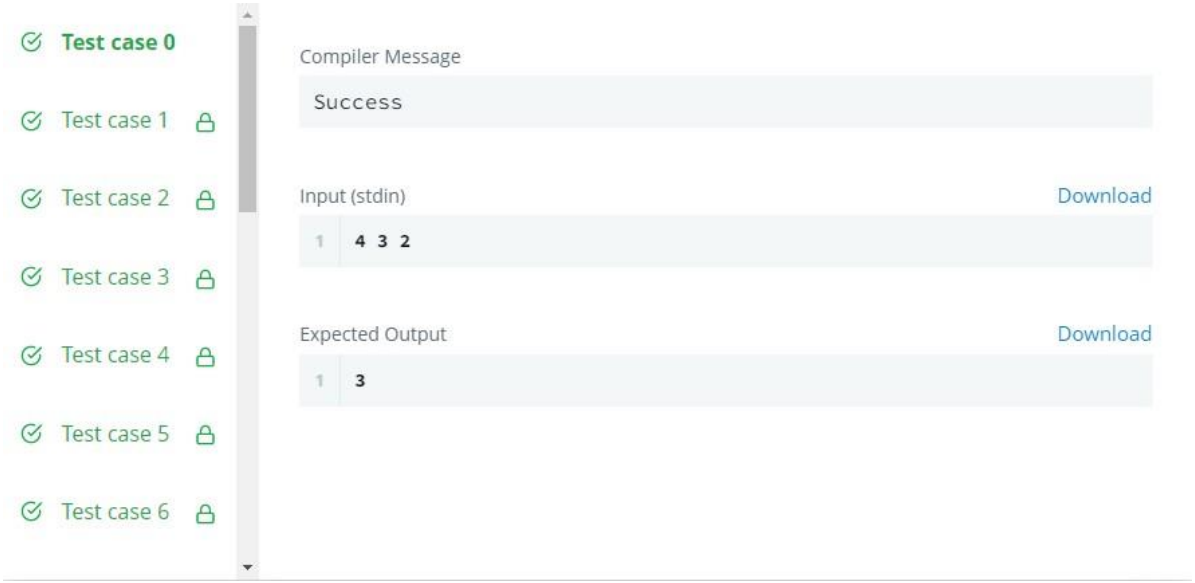
Subtasks

- For 20% of the maximum score, $n \leq 10^3$ and $k \leq 10^2$

SOLUTION:

```
public static long countArray(int n, int k, int x) {
// Return the number of ways to fill in the array.
long dp[][] = new long[n][2];
      dp[0][0] = 1;
dp[0][1] = 0;        for
(int i=1;i<n;i++)
      {
         dp[i][0] = (dp[i-1][1] * (k-1)) % 1000000007;
         dp[i][1] = (dp[i-1][0] + dp[i-1][1] * (k-2)) % 1000000007;
      }
      if (x == 1)
      {
         return dp[n-1][0];
      }
else        {
         return dp[n-1][1];
      }
   }
}
```

TEST CASES:



PROBLEM STATEMENT 8.2: -

https://www.hackerrank.com/challenges/sam-and-substrings/problem?isFullScreen=false

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Samantha and Sam are playing a numbers game. Given a number as a string, no leading zeros, determine the sum of all integer values of substrings of the string.

Given an integer as a string, sum all of its substrings cast as integers. As the number may become large, return the value modulo $10^9 + 7$.

Example

$n = '42'$

Here n is a string that has 3 integer substrings: 4, 2, and 42. Their sum is 48, and $48 \bmod (10^9 + 7) = 48$.

Function Description

Complete the substrings function in the editor below.

substrings has the following parameter(s):

- string n: the string representation of an integer

Returns

- int: the sum of the integer values of all substrings in n, modulo $10^9 + 7$

Input Format

A single line containing an integer as a string, without leading zeros.

Constraints

- $1 \leq ncastasaninteger \leq 2 \times 10^5$

SOLUTION:

```
import java.io.*; public
class Solution
{
   private final static int MOD = 1000000007;
   public static void main(String[] args) throws IOException
```

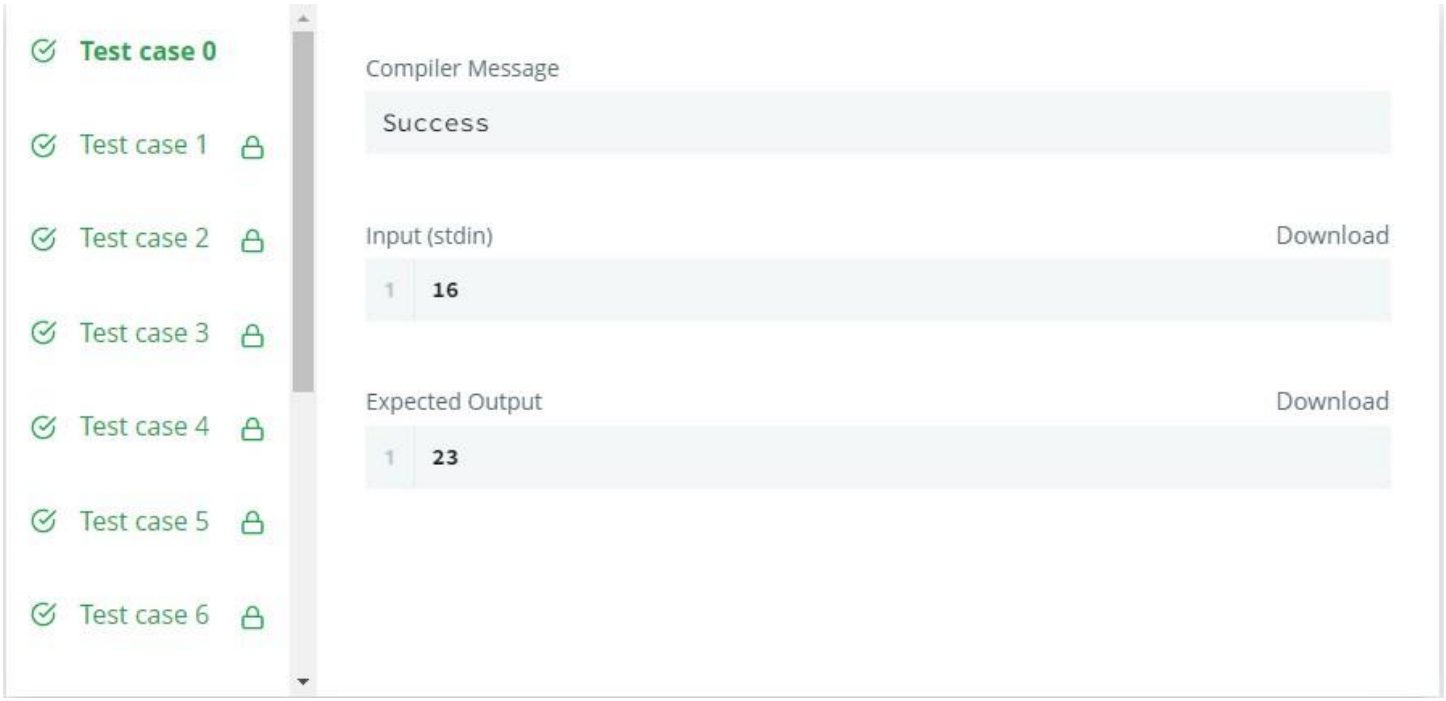
```
    {
        int[] balls = strNumToArr((new BufferedReader(new InputStreamReader(System.in))).readLine());

        int n = balls.length;
for(int i = n - 2; i >= 0; --i)
        {
            balls[i] = (int)((balls[i+1] + (((long)balls[i])*(n - i))%MOD)%MOD);
        }

        int pow = 1;
int total = 0;
        for(int i = 0; i < n; ++i)
        {
            total = (int)((total + (((long)balls[i])*pow)%MOD)%MOD);
pow = (int)((pow*10L)%MOD);
        }
        System.out.print(total);
    }

    private static int[] strNumToArr(String str)
    {        int n =
str.length();        int[] ar
= new int[n];
        for(char c : str.toCharArray())
        {
            ar[--n] = c - '0';
        }
        return ar;
    }
}
```

TEST CASES:


Test case 0
Test case 1
Test case 2
Test case 3
Test case 4
Test case 5
Test case 6
Compiler Message
Success
Input (stdin)
Download
1 16
Expected Output
Download
1 23