CODENECTION 2021 (Open Category Finals) Problemset

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1 A. Ways 1

There is a wire of integer length L lying flat. We will cut this wire at 11 integer positions to divide it into 12 smaller wires. Here, each of the 12 resulting wires must have a positive integer length. Find the number of ways to do this division. It can be proved that the answer is less than 2^{63}.

1.1 Input

L

1.2 Output

A single interger, the number of ways to divide the wire.

1.3 Constraints

$$12 \leq L \leq 200$$

1.4 Sample Input 1

```
12
```

1.5 Sample Output 1

```
1
```

1.6 Sample Input 2

```
13
```

1.7 Sample Output 2

```
12
```

2 B. Circular Campus

MMU has a circular campus. We have N buildings arranged in the campus and one of it is Kyle's faculty. Kyle is currently on the building that is S buildings away from his faculty in the clockwise direction (Means his faculty is S buildings away anti clockwise). Now he'll repeat the move : Go to the building that is K buildings away from the building he is currently in, in clockwise direction. How many moves will it take for him to reach his faculty? If he cannot reach his faculty at all, print `-1`. Test Case 1 : Kyle is on the building that is 4 buildings away from the faculty. He will be reaching his faculty after two moves of 3 buildings.

2.1 Input

First line contains an integer T. The number of testcases. Next line is, N S K

2.2 Output

A single interger, the number of moves to reach his faculty, or -1.

2.3 Constraints

$$1 \leq T \leq 100$$

$$2 \leq N \leq 10^9$$

$$1 \leq S \leq N$$

$$1 \leq K \leq 10^9$$

2.4 Sample Input 1

```
4
10 4 3
1000 11 2
998244353 897581057 595591169
10000 6 14
```

2.5 Sample Output 1

```
2
-1
249561088
3571
```

3 C. Forbidden Block

MMU Cyberjaya campus has a central court. The central court is covered with sqaure shaped cement blocks. There are NxM such blocks. Let Square (i, j) be the square at the ith row and jth column. There are K squares on the grid in which students are forbidden to set foot at. The ith forbidden block is at square (X_i, Y_i) Kyle is on square $(1, 1)$. In one move, he can move to the right or downward through any number of squares without obstacles. Find the number of blocks Kyle can reach in 2 or less moves.

Sample Explanation : Every non forbidden square can be reached with 2 or less moves.

3.1 Input

N, M, K
X_1, Y_1
.
.
X_K, Y_K

3.2 Output

A single interger, the number reachable blocks.

3.3 Constraints

$$1 \leq N, M \leq 2 \cdot 10^5$$
$$0 \leq K \leq 2 \cdot 10^5$$
$$1 \leq X_i \leq N$$
$$1 \leq Y_i \leq M$$
$$(X_i, Y_i) \neq (1, 1)$$

3.4 Sample Input 1

```
4 3 2
2 2
3 3
```

3.5 Sample Output 1

```
10
```

4 D. Campus Division

In MMU we have, N buildings, numbered $1, 2, ..., N$. M bidirectional roads connect these buildings. The ith road connects buildings A_i and B_i. Every road connects two distinct buildings. Also, for any two buildings there's at most one road that directly connects them.

One day MMU decided to divide the campus into two different campuses called Cyb and Mel. After that each building will belong to either one of these campuses. It is possible that one campus has 0 buildings. But the following condition must satisfy - * Any two buildings in a campus have a direct road between them.

Find the minimum possible number of roads whose endpoint buildings belong to the same campus. If it is impossible to make the division so that the condition is satisfied, print `-1`.

Sample : Buildings 1,2 belongs to Cyb and 3,4,5 belongs to Mel. The given condition is also satisfied. Number of roads whose endpoint buildings belong to the same campus is 4.

4.1 Input

N, M
$A_1, ..., B_1$
.
.
$A_M, ..., B_M$

4.2 Output

`-1` if the division is impossible, print the answer otherwise.

4.3 Constraints

$$2 \leq N \leq 700$$

$$0 \leq M \leq N(N-1)/2$$

$$1 \leq A_i, B_i \leq N$$

$$A_i \neq B_i$$

4.4 Sample Input 1

```
5 5
1 2
1 3
3 4
3 5
4 5
```

4.5 Sample Output 1

```
4
```

5 E. Pattern Lover

Kyle is obsessed with finding patterns. He has a binary string S which a reptition of the string `110`, 10^{10} times. (3 reptitions of the string is is `110110110`, as an example). He has another binary string T of length N. Find the number of times T occurs in S as a contiguous substring.

5.1 Input

N
T

5.2 Output

Print the answer.

5.3 Constraints

$$1 \leq N \leq 2 \cdot 10^5$$

5.4 Sample Input 1

```
4
1011
```

5.5 Sample Output 1

```
9999999999
```

6 F. Anti Pattern Lover

Elyk doesn't like when there exists similarities between things. He has a sequence X of length N. He wants to find number of all sequence Y where, $1 \leq Y_i \leq X_i$ and $Y_i \neq Y_j$ where i, j is any two elements of the sequence, as Kyle does not want any pattern between any numbers in the resulting sequence. Print the result modulo $10^9 + 7$

6.1 Input

N
$X_1, ..., X_N$

6.2 Output

Print the answer modulo $10^9 + 7$

6.3 Constraints

$$1 \leq N \leq 2 \cdot 10^5$$

$$1 \leq X_i \leq 2 \cdot 10^9$$

6.4 Sample Input 1

```
2
1 3
```

6.5 Sample Output 1

```
2
```

7 G. Last year when life was better

2019 was an amazing year. I loved 2019 so much that I want to find 2019 everywhere. So I found a random string S that contains digits `1-9`. I want to find number of pairs of integers i, j ($1 \leq i \leq j \leq$ S) where characters between ith and jth positions form an integer which is a multiple of 2019.

Sample explanation : Three pairs - (1,5), (5,9), and (9,13) - form such integers.

7.1 Input

S

7.2 Output

Print the answer.

7.3 Constraints

$$1 \leq |S| \leq 2 \cdot 10^5$$

7.4 Sample Input 1

```
1817181712114
```

7.5 Sample Output 1

```
3
```

8 H. A Joke

Dr. Kyle is taking a test and he thought there should definitely be an easy problem that everyone can solve. Here's the problem : Given a string S of length 6 print `Yes` or print `No`. To find out when to print what, students need to observe the test cases.

8.1 Input

S

8.2 Output

Print the answer.

8.3 Constraints

$$|S| == 6$$

8.4 Sample Input 1

```
lmaaoo
```

8.5 Sample Output 1

```
Yes
```

8.6 Sample Input 2

```
abcdef
```

8.7 Sample Output 2

```
No
```

8.8 Sample Input 2

```
coffee
```

8.9 Sample Output 2

```
Yes
```

8.10 Sample Input 2

```
mommaa
```

8.11 Sample Output 2

```
Yes
```

9 I. Tough Terrain

Some of MMU terrain is quite high and tough to walk on. So MMU authority decided to build a new set of stairs on the terrain. The terrain however is luckily arranged in a small rectangular shapes like this for example - # # ### # ##### The height of the i-th shape from the left is H_i. For each shape, you will perform either of the following operations once: 1. Decrease the height of the square by 1. 2. Do nothing. Determine if it is possible to perform the operations so that the heights of the shapes are non-decreasing from left to right.

Sample Explanation : You can achieve the objective by decreasing the height of only the second shape from the left by 1.

9.1 Input

N
$H_1, ..., H_N$

9.2 Output

Print `Yes` or `No`

9.3 Constraints

$$1 \leq N \leq 10^5$$

$$1 \leq H_i \leq 10^9$$

9.4 Sample Input 1

```
5
1 2 1 1 3
```

9.5 Sample Output 1

```
Yes
```

10 J. Thank You Pizza

Thank you everyone for joining. You all deserve a virtual pizza (because we're too broke to buy real pizzas). We want to make sure all of you get even numbers of pizza slices. We know that the number of participants at this final will be A or B. Help us determine the minimum number of pizza slices we need to order so that the slices can be evenly distributed to everyone in both cases.

Sample Explanation : When we have six slices, each of you can take three pieces if we have two participants, and each participant can take two if we have three participants.

10.1 Input

A, B

10.2 Output

A single integer, the number of slices we need to order.

10.3 Constraints

$$1 \leq A, B \leq 10^5$$

10.4 Sample Input 1

```
2 3
```

10.5 Sample Output 1

```
6
```