Competitive Programming SS24

Submit until end of contest

Problem: dna (1.0 second timelimit)

Note: This is a problem that is harder to solve than usual. Solve the other problems first before spending too much time on this one.

You were writing an algorithm analyzing DNA sequences, represented as strings consisting only of the four letters `C`, `G`, `A`, and `T`. The algorithm was looking for all occurrences of a subsequence you are interested in.

You tested it on some real world DNA sequences as well as some randomly created ones. Now you have the results, however, you forgot to save which result belongs to which input sequence.

Considering that real world DNA is far from random, you think you can at least separate which results come from a random sequence and which ones don't. For that, you want to look at the probability that a uniformly random sequence leads to a given result. However, you don't trust your code to have found all occurrences of the subsequence. Additionally, your algorithms results might not make sense at all, leading to a probability of zero.

It can be proven that the probability you are looking for can be represented as a fraction P/Q for some integers P and Q. Output $P \cdot Q^{-1}$ modulo $10^9 + 7$.

Input The first line contains three integers n, m, k, the length of the DNA sequence, the length of the subsequence, and the number of occurrences found by your algorithm ($1 \leq m \leq n \leq 10^6$, $1 \leq k \leq n - m + 1$). The second line the subsequence of length m, consisting only of the four letters `C`, `G`, `A`, and `T`. The third line contains k integers $p_1, \ldots, p_k$ ($1 \leq p_1 < p_2 < \cdots < p_k \leq n - m + 1$), the positions your algorithm found.

Output Output the probability that a uniformly random DNA sequence of length n contains the given subsequence at each of the given positions p_i (and maybe more). You should output the probability as a fraction modulo $10^9 + 7$.

Sample input

```
7 3 2
AGA
2 4
```

Sample output

```
71289063
```

```
7 3 2
AGA
2 3
```

```
0
```