IOITC 2022 TST 3

Median Communication

Alice, Bob and Carol play a game. Alice and Bob are in separate rooms with no means of communication, other than what is facilitated by Carol.

Let S be the set of integers lying in the closed interval $[0, n-1]$. Initially, Carol chooses an integer k satisfying $2 \leq 2k \leq n$. Then, she chooses two disjoint subsets of S, A and B, each having k elements. Carol also thinks of a value l. Carol then goes to Alice, tells her the values of n, k, l and all values of the set A. Now, she goes to Bob and tells him the values of n, k, l and all values in the set B. The following is repeated l times:

1. Carol goes to Alice and asks for a single value, u, which is either 0 or 1. She then goes to Bob and asks for a single value, v, which is either 0 or 1.
2. Carol now reports v to Alice and u to Bob.

Finally, Carol asks both Alice and Bob individually, the median of the union of the sets A and B (the union contains $2k$ elements, so the median is defined as the kth least element in the set). To pass, **both** Alice or Bob must report the median correctly. Note that both Alice and Bob are aware that they will be given disjoint subsets of S of the same size. They are both aware of the rules of the game and can discuss strategy in advance.

Implementation Details

Please download `dummy_solution.cpp` and read it carefully for implementation details.

- Do not delete or change any code in the `dummy_solution.cpp` starting from the `main` function.
- You shouldn't try to communicate any data between the structs for Alice and Bob. This means all code that you write should be enclosed between either of the two structs.
- You cannot use any C++ language tricks to break the communication protocol. If you are wondering if something you use is allowed or not, then try to think if the solution you write can be implemented in the real life situation described in the problem statement. If you can't, then it's disallowed. Seek clarifications if you are still unsure.
- It is strictly prohibited to print anything to `stdout` in any submission. It is strongly suggested that you use `stderr` for local debugging as well.

Test Data

In all test data, $n = 9999$.

Subtask 1 (4 Points): $l = 200000$

Subtask 2 (8 Points): $l = 10000$

Subtask 3 (13 Points): $k \leq 100$, $l = 1500$

Subtask 4 (17 Points): $l = 250$

Subtask 5 (12 Points): $k = \frac{n-1}{2}$, $l = 40$

Subtask 6 (46 Points): $l = 40$

Local testing

You are provided with a dummy solution with the name `dummy_solution.cpp`. You should compile your solution as:

```
g++ dummy_solution.cpp -o grader
```

Then you can run `./grader`, and give input of the form as follows:

- The first line contains n, k and l
- The second line contains k integers denoting Alice's set
- The third line contains k integers denoting Bob's set

Limits

Time: 1 seconds

Memory: 256 MB