WOBURN CHALLENGE

2015-16 Online Round 4

Friday, April 8th, 2016

Junior Division Problems

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wcipeg.com

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Problem J1: Telling Time

7 Points / Time Limit: 7.00s / Memory Limit: 16M *Submit online: wcipeg.com/problem/wc154j1*

James Bond is preparing to embark on a particularly dangerous mission – catching ruthless Canadian ice wine smugglers. He'll be attending a secret (but elegant) wine tasting party at the smugglers' hideout, with the intention of causing a huge distraction and sneaking further into their lair. If only there were a way to suddenly disrupt the wine tasting process for all of the guests...

Fortunately for Bond, Q has an idea. According to his research, the glass which the wine glasses are made of has a resonance frequency of G ($800 \le G \le 8000$) Hz. If a loud noise were to be emitted in the room, with a frequency which is an exact multiple of the glass's resonance frequency, the wine glasses could be made to all shatter at once, giving Bond just the kind of distraction he'll need!

Q has developed N ($1 \le N \le 100$) fancy watches for this mission. Aside from helping Bond look the part of a rich wine collector (and be able to tell the time), the watches have powerful auditory emitters embedded within them! The i-th watch can emit noise at a frequency of F_i ($500 \le F_i \le 100{,}000$) Hz.

Though all N watches can keep time accurately, only the ones with frequencies which are exact multiples of G Hz will be of use to Bond for this mission. Please help Q count how many of his watches he could potentially give to Bond!

Input Format

The first line of input consists of two space-separated integers N and G.
The next N lines each consist of a single integer F_i, for $i = 1..N$.

Output Format

Output a single integer – the number of watches which are able to break the glass.

Sample Input

```
4 2000
6000
1000
2000
20001
```

Sample Output

```
2
```

Problem J2: Mission Briefing

20 Points / Time Limit: 2.00s / Memory Limit: 16M *Submit online: wcipeg.com/problem/wc154j2*

You've gotten your hands on M's writeup of plans for an upcoming MI6 mission. This mission briefing is a single string, whose length is between 1 and 1000 (inclusive), and which consists only of letters, digits, periods, and commas (no whitespace).

You know that 9 different MI6 agents may be involved in this mission – the agents with code names 001, 002, 003, 004, 005, 006, 007, 008, and 009. Some of their code names may appear in the mission briefing, even multiple times, while others may not. Their code names may occur anywhere in the string, not necessarily immediately before or after punctuation. You're interesting in counting the number of different agents whose code names can be found in the text at least once.

Input Format

The first and only line of input consists of a single string representing a transcript of the the mission briefing.

Output Format:

Output a single integer – the number of different agents (from 001 to 009) whose code names appear in the mission briefing.

Sample Input

```
Agent.007.will.take.up.position.on.the.roof.of.20001.Wales.Street,while.002.and.009
.will.cover.the.entrance...007.will.take.the.first.shot.
```

Sample Output

```
4
```

Problem J3: Shootout

33 Points / Time Limit: 4.00s / Memory Limit: 64M *Submit online: wcipeg.com/problem/wc154s1*

James Bond's latest mission is not going as planned. He's suddenly found himself at one end of a long, narrow corridor which is filled with N ($1 \le N \le 200{,}000$) of Blofeld's henchmen. The i-th henchman is standing H_i ($1 \le H_i \le 10^9$) metres away from Bond along the corridor.

There are also M ($0 \le M \le 200{,}000$) doors in the corridor, all of which are initially closed, with the i-th door D_i ($1 \le D_i \le 10^9$) metres away from Bond along the corridor. Of the $N + M$ henchmen and doors, no two of them are at the same location.

The building's security system will open all of the doors in order, one after another, starting from door 1 and ending with door M. Once each door has been opened, it will stay open permanently. In order to do his best to die another day, Bond will need to quickly assess how many of the henchmen are currently in his line of fire after each door is opened. A henchman is in Bond's line of fire if there are no closed doors between them and Bond.

Fortunately, Bond brought along his personal computer to the gunfight to help with these computations. Unfortunately, he forgot to get the floppy disk containg the program from Q! As quickly as you can, for each i from 1 to M, please help Bond determine how many of the N henchmen will be in his line of fire after the first i doors have been opened.

Subtasks

In test cases worth 5/33 of the points, $N \le 100$ and $M \le 100$.
In test cases worth another 8/33 of the points, $N \le 200$ and $M \le 3000$.
In test cases worth another 8/33 of the points, $N \le 200$ and $M \le 40{,}000$.

Input Format

The first line of input consists of two space-separated integers N and M.
The next N lines each consist of a single integer H_i, for $i = 1..N$.
The next M lines each consist of a single integer D_i, for $i = 1..M$.

Output Format

Output M lines with one integer per line.
The i-th line of output (for $i = 1..M$) should consist of the number of henchmen in Bond's line of fire after i doors have been opened.

Sample Input

```
5 4
2
300
4
15
1000000000
200
3
100
301
```

Sample Output

```
1
3
4
5
```

Problem J4: Target Practice

40 Points / Time Limit: 4.00s / Memory Limit: 64M *Submit online: wcipeg.com/problem/wc154j4*

In between missions, Bond makes sure to keep his trigger finger in shape. Today, he's hitting the firing range at MI6 headquarters.

His target consists of N ($1 \le N \le 10^5$) concentric rings drawn on a piece of graph paper, centered at the origin. The rings are numbered 1 to N from smallest to largest, with the i-th ring having an outer radius of R_i ($1 \le R_1 < R_2 < \ldots < R_N < 10^9$).

Each ring includes its outer radius, but not its inner radius – for example, if a bullet hits exactly R_i units away from the origin, then it's considered to land inside ring i, but if it's slightly further away, then it instead lands inside ring $i + 1$. If a shot strikes no further than R_1 units away from the origin, then it naturally lands inside ring 1. The i-th ring is worth P_i ($1 \le P_i \le 1000$) points if it's hit.

Bond has fired M ($1 \le M \le 10^6$) shots at the target, with the ith one striking at coordinates (X_i, Y_i) ($-10^9 \le X_i, Y_i \le 10^9$), and is now waiting to be notified of his total score. Each shot will be awarded points based on which ring it landed in, except for shots which landed strictly outside the outer radius of ring N, which will receive 0 points.

Q is in charge of tallying up the points, but he's decided to play a little trick on Bond – rearranging the rings' point values! Given that he may permute the values $P_{1..N}$ in any way he'd like before computing and adding up the Mshots' scores, he's wondering how small or large Bond's total score could possibly end up being. After the stunt Bond pulled last week with taking Q's brilliant new automobile for a little unauthorized test drive, and promptly causing it to internally combust (and not in a good way), we can only imagine whether Q will choose to give Bond the smallest or largest possible score... However, in any case, can you please help him determine both of these values?

Subtasks

In test cases worth 6/40 of the points, $N \le 10$ and $M \le 20$.
In test cases worth another 10/40 of the points, $N \le 800$ and $M \le 400$.
In test cases worth another 12/40 of the points, $N \le 10^5$ and $M \le 400$.

Input Format

The first line of input consists of two space-separated integers N and M.
The next N lines each consist of a single integer R_i, for $i = 1..N$.
The next N lines each consist of a single integer P_i, for $i = 1..N$.
The next M lines each consist of two space-separated integers X_i and Y_i, for $i = 1..M$.

Output Format

Output two integers – the minimum and maximum total scores that Bond could possibly get.

Sample Input

```
3 5
10
100
1000
10
1
9
4 20
0 -10
1001 0
0 0
-300 -300
```

Sample Output

```
21
30
```

Explanation

Bond's total score is 21 if P = [1, 9, 10].
Bond's total score is 30 if P = [10, 9, 1].