# Competitive Programming Contest: Game Theory

## A. Battle of Spirits

1 second, 256 megabytes

In a land full of magic with constant battles, Harry is a wizard with an initial strength of zero. Fortunately, he can call upon $n$ magical spirits to protect him. However, some of these spirits can be evil and harm Harry instead of helping him. To get a clearer picture, Harry assigns a strength value $s_i$ for each spirit $i$. A positive or zero value indicates a kind spirit that increases Harry's strength by that amount, whereas a negative value represents an evil spirit that reduces Harry's strength by that amount.

Harry is up against a strong enemy, a bandit who also starts with zero strength. This bandit, however, has a special power to steal Harry's spirits for herself. These stolen spirits could increase or decrease her strength, just as they would for Harry. The good news is that this bandit has limited mana, which only allows her to steal up to $q$ spirits.

Harry summons spirits to aid him in the fight.

Knowing this, Harry realizes he should get rid of some of his spirits before the fight. He doesn't want the bandit to take his spirits and use them against him. His grade, $p$, represents the maximum number of spirits he can exorcise. If his grade exceeds one, he is considered a world-class wizard, where even the most devious evil spirits dare not be summoned for fear of being exorcised!

Harry wants to be much stronger than the bandit to win the fight gloriously. Formally, he wants to achieve the maximum **dominance**, that is, the difference between his and the bandit's strength. On the other hand, the bandit aims to minimize Harry's dominance.

What would be Harry's dominance if they both make the optimal moves?

### Input

The first line of input contains three integers $n$, $p$, and $q$ ($1 \le n \le 4 \cdot 10^5, 0 \le p, q \le n$) — the number of magical spirits Harry summons, the grade of Harry, and the maximum number of spirits that the bandit can steal.

The second line of input contains $n$ integers $s_1, s_2, \ldots, s_n$ ($1 \le s_i \le 500$), where $s_i$ is the strength value of spirit $i$.

It is guaranteed that all spirits are kind when Harry's grade is a world-class wizard, i.e. $p > 1 \implies s_i \ge 0$.

### Output

Output a single integer — the dominance of Harry at the end of the fight if both he and the bandit act optimally.

### Scoring

| Group | Points | Constraints |
|---|---|---|
| 1 | 4 | Harry couldn't get rid of any of his spirits, i.e. $p = 0$ |
| 2 | 7 | Harry could only get rid of at most one spirit, i.e. $p = 1$ |
| 3 | 19 | No additional constraints |

**input**

```
4 0 2
-50 10 20 30
```

**output**

```
-90
```

**input**

```
3 1 1
-10 30 40
```

**output**

```
-10
```

**input**

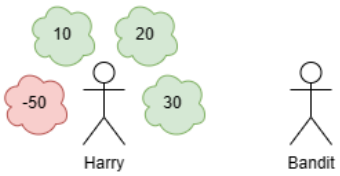
```
5 2 3
4 7 9 12 20
```

**output**

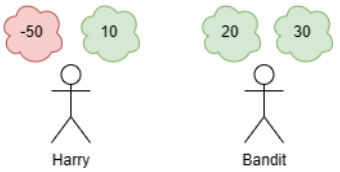
```
-20
```

In the first example:

Initially, Harry summons four spirits to support him.



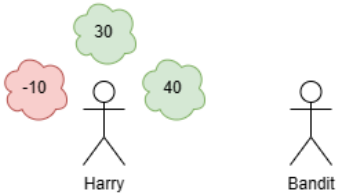

However, the bandit steals the two strongest spirits, leaving Harry with only the weakest spirit and an evil spirit.



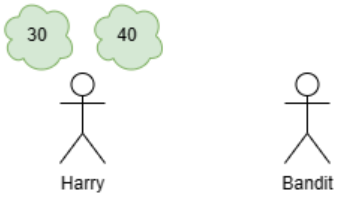

In the end, the dominance of Harry is $(-50 + 10) - (20 + 30) = -90$.

In the second example:

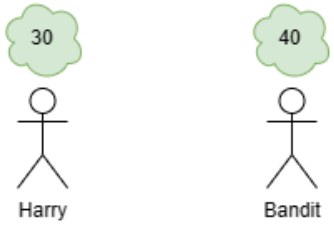
Harry summons three spirits before the fight.




Before the bandit can act, Harry quickly gets rid of the evil spirit.




Nevertheless, the bandit steals the spirit with a strength value of $40$. Hence, Harry's dominance is $30 - 40 = -10$.




**Hints**

- No matter what Harry did, the bandit will always execute the same strategy.
- How should Harry minimize the impact of the bandit's spirit-stealing technique?

## B. Sea of Shattered Glass

2 seconds, 256 megabytes

Are you ready, kids?

In the adventurous world of pirates, life is full of surprises, especially for Mr. Krabs, who proudly owns a unique collection of $n$ glass cannons. He has arranged them in a straight line on his pirate ship, ready for any battle. One day, while sailing the high seas, Mr. Krabs spots another pirate ship. This ship belongs to Painty the Pirate, a well-known figure among pirates. As they get closer, Mr. Krabs notices something interesting: Painty has the same number of glass cannons on his ship, all lined up just like his!

Curious and excited, Mr. Krabs decides to have a chat with Painty about how to take care of such delicate yet powerful weapons. But while they are talking, Painty suddenly attacks and destroys one of Mr. Krabs' glass cannons! It turns out Painty is not just a pirate; he's a sneaky one at that! Realizing he has been tricked, Mr. Krabs doesn't waste time and strikes back, destroying one of Painty's cannons in return. They quickly learn that firing these glass cannons isn't easy, meaning they can only attack one at a time, taking turns.

Each of these glass cannons, whether they belong to Mr. Krabs or Painty, has its own value. For Mr. Krabs, the value of each cannon $i$ is represented as $c_i$, and for Painty, it's $d_i$. They are positioned such that only cannons with the same number can attack each other. Therefore, the only way to protect a glass cannon is to attack and destroy the opponent's cannon it is facing!

Now, Mr. Krabs wants to end this battle with the maximum **happiness** possible. His happiness is measured by the difference between the total value of his and Painty's remaining glass cannons at the end of the fight. Both captains want to make smart moves: Mr. Krabs aims to maximize his happiness, while Painty tries to minimize it.

Calculate the happiness of Mr. Krabs if both he and Painty act optimally during their cannon duel.

### Input

The first line of input contains a single integer $n$ ($2 \le n \le 2 \cdot 10^5$) — the number of glass cannons on each pirate ship.

The second line of input contains $n$ integers $c_1, c_2, \ldots, c_n$ ($1 \le c_i \le 10^9$), where $c_i$ is the value of glass cannon $i$ of Mr. Krabs.

The third line of input contains $n$ integers $d_1, d_2, \ldots, d_n$ ($1 \le d_i \le 10^9$), where $d_i$ is the value of glass cannon $i$ of Painty.

### Output

Output a single integer — the happiness of Mr. Krabs at the end of the fight if both he and Painty make the optimal decisions.

### Scoring

| Group | Points | Constraints |
|---|---|---|
| $1$ | $6$ | Each cannon of Mr. Krabs has a value of $1$, i.e. $c_i = 1$ |
| $2$ | $8$ | There are only two cannons on each pirate ship, i.e. $n = 2$ |
| $3$ | $12$ | There are only three cannons on each pirate ship, i.e. $n = 3$ |
| $4$ | $24$ | No additional constraints |

**input**

```
2
24 65
42 13
```

**output**

```
11
```

**input**

```
3
30 10 50
20 50 10
```

**output**

```
-20
```

**input**

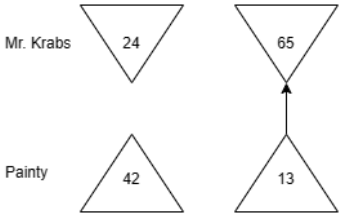
```
6
4 8 3 7 1 10
6 7 1 2 5 100
```

**output**

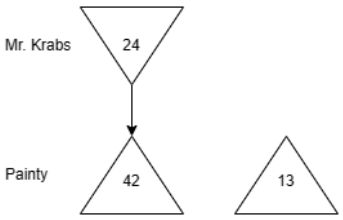
```
-93
```

In the first example:

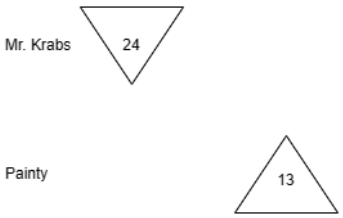
Painty first chooses to attack Mr. Krabs' cannon with the greatest value.




Left with no other options, Mr. Krabs must attack with his only remaining cannon.




When the fight ends, the happiness of Mr. Krabs is calculated as $24 - 13 = 11$.




**Hints**

- When there are only two cannons, Mr. Krabs has no freedom to choose his target.
- What is the optimal strategy for both Mr. Krabs and Painty?