A - Insert

Time Limit: 2 sec / Memory Limit: 1024 MB

Score : 100 points

Problem Statement

You are given an integer sequence A of length N and integers K and X.
Print the integer sequence B obtained by inserting the integer X immediately after the K-th element of the sequence A.

Constraints

- All input values are integers.
- $1 \leq K \leq N \leq 100$
- $1 \leq A_i, X \leq 100$

Input

The input is given from Standard Input in the following format:

$$N \quad K \quad X$$
$$A_1 \quad A_2 \quad \ldots \quad A_N$$

Output

Print the integer sequence B obtained by inserting the integer X immediately after the K-th element of the sequence A, in the following format:

$$B_1 \quad B_2 \quad \ldots \quad B_{N+1}$$

Sample Input 1

```
4 3 7
2 3 5 11
```

Sample Output 1

```
2 3 5 7 11
```

For $K = 3$, $X = 7$, and $A = (2, 3, 5, 11)$, we get $B = (2, 3, 5, 7, 11)$.

Sample Input 2

```
1 1 100
100
```

Sample Output 2

```
100 100
```

Sample Input 3

```
8 8 3
9 9 8 2 4 4 3 5
```

Sample Output 3

```
9 9 8 2 4 4 3 5 3
```

B - Intersection of Cuboids

Time Limit: 2 sec / Memory Limit: 1024 MB

Score : 250 points

Problem Statement

> You are trying to implement collision detection in a 3D game.

In a 3-dimensional space, let $C(a,b,c,d,e,f)$ denote the cuboid with a diagonal connecting (a,b,c) and (d,e,f), and with all faces parallel to the xy-plane, yz-plane, or zx-plane.
(This definition uniquely determines $C(a,b,c,d,e,f)$.)

Given two cuboids $C(a,b,c,d,e,f)$ and $C(g,h,i,j,k,l)$, determine whether their intersection has a positive volume.

Constraints

- $0 \leq a < d \leq 1000$
- $0 \leq b < e \leq 1000$
- $0 \leq c < f \leq 1000$
- $0 \leq g < j \leq 1000$
- $0 \leq h < k \leq 1000$
- $0 \leq i < l \leq 1000$
- All input values are integers.

Input

The input is given from Standard Input in the following format:

$$\begin{array}{llllll} a & b & c & d & e & f \\ g & h & i & j & k & l \end{array}$$

Output

Print `Yes` if the intersection of the two cuboids has a positive volume, and `No` otherwise.

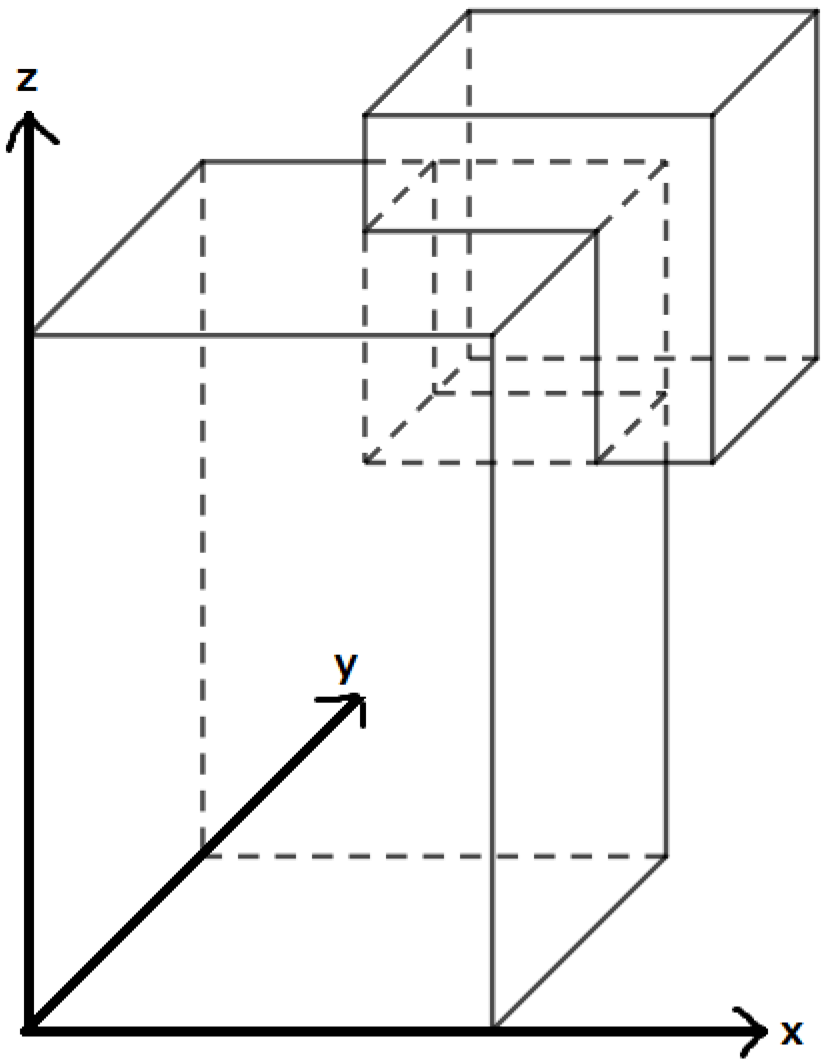
Sample Input 1

```
0 0 0 4 5 6
2 3 4 5 6 7
```

Sample Output 1

```
Yes
```

The positional relationship of the two cuboids is shown in the figure below, and their intersection has a volume of 8.



Sample Input 2

```
0 0 0 2 2 2
0 0 2 2 2 4
```

Sample Output 2

```
No
```

The two cuboids touch at a face, where the volume of the intersection is 0.

Sample Input 3

```
0 0 0 1000 1000 1000
10 10 10 100 100 100
```

Sample Output 3

```
Yes
```

C - Make Them Narrow

Time Limit: 2 sec / Memory Limit: 1024 MB

Score : 250 points

Problem Statement

You are given a sequence A of length N.

Freely choose exactly K elements from A and remove them, then concatenate the remaining elements in their original order to form a new sequence B.

Find the minimum possible value of this: the maximum value of B minus the minimum value of B.

Constraints

- All inputs are integers.
- $1 \leq K < N \leq 2 \times 10^5$
- $1 \leq A_i \leq 10^9$

Input

The input is given from Standard Input in the following format:

$$
\begin{array}{l}
N \quad K \\
A_1 \quad A_2 \quad \ldots \quad A_N
\end{array}
$$

Output

Print the answer as an integer.

Sample Input 1

```
5 2
3 1 5 4 9
```

Sample Output 1

```
2
```

Consider removing exactly two elements from $A = (3, 1, 5, 4, 9)$.

- For example, if you remove the 2nd element 1 and the 5th element 9, the resulting sequence is $B = (3, 5, 4)$.
  - In this case, the maximum value of B is 5 and the minimum value is 3, so (maximum value of B) $-$ (minimum value of B) $= 2$, which is the minimum possible value.

Sample Input 2

```
6 5
1 1 1 1 1 1
```

Sample Output 2

```
0
```

Sample Input 3

```
8 3
31 43 26 6 18 36 22 13
```

Sample Output 3

```
18
```

D - Go Stone Puzzle

Time Limit: 2 sec / Memory Limit: 1024 MB

Score : 425 points

Problem Statement

There are $N+2$ cells arranged in a row. Let cell i denote the i-th cell from the left.

There is one stone placed in each of the cells from cell 1 to cell N.
For each $1 \leq i \leq N$, the stone in cell i is white if S_i is `W`, and black if S_i is `B`.
Cells $N+1$ and $N+2$ are empty.

You can perform the following operation any number of times (possibly zero):

- Choose a pair of adjacent cells that both contain stones, and move these two stones to the empty two cells while preserving their order.
  More precisely, choose an integer x such that $1 \leq x \leq N+1$ and both cells x and $x+1$ contain stones. Let k and $k+1$ be the empty two cells. Move the stones from cells x and $x+1$ to cells k and $k+1$, respectively.

Determine if it is possible to achieve the following state, and if so, find the minimum number of operations required:

- Each of the cells from cell 1 to cell N contains one stone, and for each $1 \leq i \leq N$, the stone in cell i is white if T_i is `W`, and black if T_i is `B`.

Constraints

- $2 \leq N \leq 14$
- N is an integer.
- Each of S and T is a string of length N consisting of `B` and `W`.

Input

The input is given from Standard Input in the following format:

$$
\begin{array}{l}
N \\
S \\
T
\end{array}
$$

Output

If it is possible to achieve the desired state, print the minimum number of operations required. If it is impossible, print `-1`.

Sample Input 1

```
6
BWBWBW
WWWBBB
```

Sample Output 1

```
4
```

Using `.` to represent an empty cell, the desired state can be achieved in four operations as follows, which is the minimum:

- `BWBWBW..`
- `BW..BWBW`
- `BWWBB..W`
- `..WBBBWW`
- `WWWBBB..`

Sample Input 2

```
6
BBBBBB
WWWWWW
```

Sample Output 2

```
-1
```

Sample Input 3

```
14
BBBWBWWWBBWWBW
WBWWBBWWWBWBBB
```

Sample Output 3

```
7
```

E - Tree and Hamilton Path 2

Time Limit: 2 sec / Memory Limit: 1024 MB

Score : 500 points

Problem Statement

In the nation of AtCoder, there are N cities numbered 1 to N and $N-1$ roads numbered 1 to $N-1$.

Road i connects cities A_i and B_i bidirectionally, and its length is C_i. Any pair of cities can be reached from each other by traveling through some roads.

Find the minimum travel distance required to start from a city and visit all cities at least once using the roads.

Constraints

- $2 \leq N \leq 2 \times 10^5$
- $1 \leq A_i, B_i \leq N$
- $1 \leq C_i \leq 10^9$
- All input values are integers.
- Any pair of cities can be reached from each other by traveling through some roads.

Input

The input is given from Standard Input in the following format:

$$
\begin{array}{l}
N \\
A_1 \quad B_1 \quad C_1 \\
\vdots \\
A_{N-1} \quad B_{N-1} \quad C_{N-1}
\end{array}
$$

Output

Print the answer.

Sample Input 1

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

Sample Output 1

```
11
```

If you travel as $4 \to 1 \to 2 \to 1 \to 3$, the total travel distance is 11, which is the minimum.

Note that you do not need to return to the starting city.

Sample Input 2

```
10
10 9 1000000000
9 8 1000000000
8 7 1000000000
7 6 1000000000
6 5 1000000000
5 4 1000000000
4 3 1000000000
3 2 1000000000
2 1 1000000000
```

Sample Output 2

```
9000000000
```

Beware overflow.

F - x = a^b

Time Limit: 2 sec / Memory Limit: 1024 MB

Score : 500 points

Problem Statement

How many integers x between 1 and N, inclusive, can be expressed as $x = a^b$ using some positive integer a and a positive integer b **not less than** 2?

Constraints

- All input values are integers.
- $1 \leq N \leq 10^{18}$

Input

The input is given from Standard Input in the following format:

N

Output

Print the answer as an integer.

Sample Input 1

```
99
```

Sample Output 1

```
12
```

The integers that satisfy the conditions in the problem statement are $1, 4, 8, 9, 16, 25, 27, 32, 36, 49, 64, 81$: there are 12.

Sample Input 2

```
1000000000000000000
```

Sample Output 2

```
1001003332
```

G - Go Territory

Time Limit: 4 sec / Memory Limit: 1024 MB

Score : 600 points

Problem Statement

There are N stones placed on a 2-dimensional plane. The i-th stone is located at coordinates (X_i, Y_i). All stones are located at lattice points in the first quadrant (including the axes).

Count the number of lattice points (x, y) where no stone is placed and it is **impossible** to reach $(-1, -1)$ from (x, y) by repeatedly moving up, down, left, or right by 1 without passing through coordinates where a stone is placed.

More precisely, count the number of lattice points (x, y) where no stone is placed, and there does **not** exist a finite sequence of integer pairs $(x_0, y_0), \ldots, (x_k, y_k)$ that satisfies all of the following four conditions:

- $(x_0, y_0) = (x, y)$.
- $(x_k, y_k) = (-1, -1)$.
- $|x_i - x_{i+1}| + |y_i - y_{i+1}| = 1$ for all $0 \leq i < k$.
- There is no stone at (x_i, y_i) for all $0 \leq i \leq k$.

Constraints

- $0 \le N \le 2 \times 10^5$
- $0 \le X_i, Y_i \le 2 \times 10^5$
- The pairs (X_i, Y_i) are distinct.
- All input values are integers.

Input

The input is given from Standard Input in the following format:

$$
\begin{array}{l}
N \\
X_1 \quad Y_1 \\
\vdots \\
X_N \quad Y_N
\end{array}
$$

Output

Print the number of lattice points that satisfy the conditions.

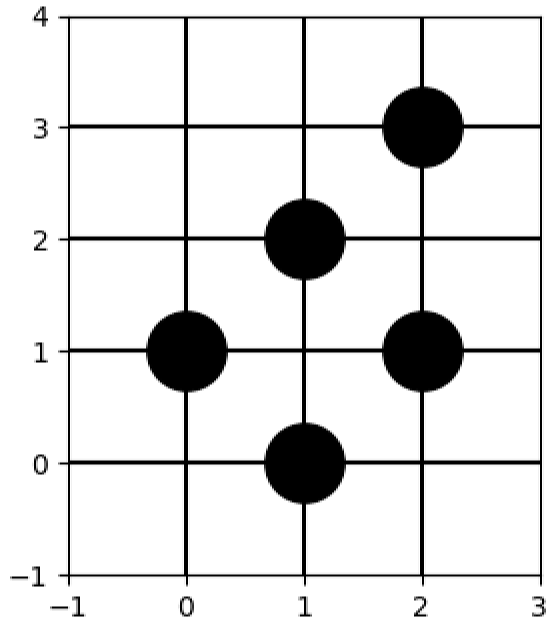
Sample Input 1

```
5
1 0
0 1
2 3
1 2
2 1
```

Sample Output 1

```
1
```

It is impossible to reach $(-1, -1)$ from $(1, 1)$.



Sample Input 2

```
0
```

Sample Output 2

```
0
```

There may be cases where no stones are placed.

Sample Input 3

```
22
0 1
0 2
0 3
1 0
1 4
2 0
2 2
2 4
3 0
3 1
3 2
3 4
5 1
5 2
5 3
6 0
6 4
7 0
7 4
8 1
8 2
8 3
```

Sample Output 3

```
6
```

There are six such points: $(6,1),(6,2),(6,3),(7,1),(7,2),(7,3)$.