A - Bacteria Growth Experiment

Time Limit: 2 sec / Memory Limit: 1024 MiB

Score : 166 pts

Problem Statement

Takahashi is conducting a bacteria growth experiment in a biology laboratory.

In this experiment, bacteria colonies grow in a special culture medium. Each colony divides at regular intervals, and a new colony with exactly 2 times the size of the original colony is born.

At the start of the experiment, there is only 1 colony of size 1 in the culture medium. After that, the following growth occurs K times.

Growth: For each colony that currently exists, a new colony with twice the size of that colony is born. At this time, the original colony also remains.

In other words, the number of colonies increases each time growth occurs. However, there may be multiple colonies of the same size, but since the research records them classified by size, colonies of the same size are counted as 1 type.

After K growths have occurred, how many types of colonies exist in the culture medium? In other words, find the number of distinct values that appear as sizes of existing colonies.

Constraints

- $1 \leq K \leq 10^{18}$
- K is an integer

Input

K

- The first line contains an integer K representing the number of growths.

Output

Output the number of types of colonies (the number of distinct sizes) after K growths in a single line.

Sample Input 1

Copy

2

Sample Output 1 Copy

```
3
```

Sample Input 2 Copy

```
10
```

Sample Output 2 Copy

```
11
```

Sample Input 3 Copy

```
1000000000000000000
```

Sample Output 3 Copy

```
1000000000000000001
```

B - Exam Passers

Time Limit: 2 sec / Memory Limit: 1024 MiB

Score : 233 pts

Problem Statement

Takahashi is a school teacher who is tallying the results of the final exam.

In this exam, only students who scored at least L points and at most R points will pass. Students who scored too low will not pass, and students who scored too high are also suspected of cheating, so they will not pass either.

N students took this exam, and the i-th student scored P_i points.

Takahashi wants to know the student ID of the student with the highest score among those who passed.

Find the student ID of the student with the maximum score among the students who passed. If there are multiple such students, output the student ID of the one with the smallest student ID. However, if no students passed, output `-1` .

Constraints

- $1 \leq N \leq 2 \times 10^5$
- $0 \leq L \leq R \leq 100$
- $0 \leq P_i \leq 100\ (1 \leq i \leq N)$
- All inputs are integers

Input

$$
\begin{array}{llll}
N & L & R & \\
P_1 & P_2 & \ldots & P_N
\end{array}
$$

- The first line contains N representing the number of students, L representing the lower bound of passing scores, and R representing the upper bound, separated by spaces.
- The second line contains $P_1, P_2, \ldots, P_N$ representing each student's score, separated by spaces.

Output

Output the student ID of the student with the maximum score among the students who passed, on a single line. If no such student exists, output `-1` .

Sample Input 1 Copy

```
5 60 80
55 72 80 90 65
```

Sample Output 1 Copy

```
3
```

Sample Input 2 Copy

```
8 50 70
45 70 60 70 80 55 30 68
```

Sample Output 2 Copy

```
2
```

Sample Input 3 Copy

```
10 40 60
35 100 25 55 60 60 75 42 38 90
```

Sample Output 3 Copy

```
5
```

C - Discount Coupon

Time Limit: 2 sec / Memory Limit: 1024 MiB

Score : 300 pts

Problem Statement

Takahashi is about to go shopping on an online shopping site.

The shopping site has N items, and each item i has a price of D_i yen. Takahashi plans to purchase all the items.

Takahashi has a special discount coupon. By using this coupon, he can reduce the price of selected items to 0 yen. However, there is a restriction that the coupon can be applied to at most K items.

Takahashi wants to use the coupon optimally to minimize the total amount he pays. Find the minimum total amount he needs to pay when using the coupon optimally.

Constraints

- $1 \leq N \leq 2 \times 10^5$
- $0 \leq K \leq N$
- $1 \leq D_i \leq 10^9$
- All inputs are integers

Input

$$
\begin{array}{llll}
N & K & & \\
D_1 & D_2 & \ldots & D_N
\end{array}
$$

- The first line contains N, representing the number of items, and K, representing the maximum number of items the coupon can be applied to, separated by a space.
- The second line contains $D_1, D_2, \ldots, D_N$, representing the price of each item, separated by spaces.

Output

Output the minimum total amount to pay in one line.

Sample Input 1

Copy

```
5 2
100 250 300 150 200
```

Sample Output 1 Copy

```
450
```

Sample Input 2 Copy

```
7 3
500 1200 800 300 950 1100 450
```

Sample Output 2 Copy

```
2050
```

Sample Input 3 Copy

```
10 4
1000000000 999999999 500000000 750000000 250000000 800000000 600000000 400000000 350000000 900000000
```

Sample Output 3 Copy

```
2850000000
```

D - Merchant on the Highway

Time Limit: 2 sec / Memory Limit: 1024 MiB

Score : 400 pts

Problem Statement

Takahashi is a merchant doing business along a highway that extends from east to west. There are N towns lined up in a row along this highway, numbered $1, 2, ..., N$ from west to east. Doing business in the i-th town yields a profit of A_i, but costs B_i yen as accommodation expenses.

Takahashi has decided to select some of these towns to do business in. However, Takahashi's carriage has the following restriction:

- The towns visited do not need to have consecutive numbers, but when the visited town numbers are arranged in ascending order, the difference between any two adjacent numbers must be at most K. In other words, if the visited town numbers in ascending order are $p_1, p_2, \ldots, p_m$, then $p_{j+1} - p_j \leq K$ must hold for all $1 \leq j \leq m-1$. This is because the carriage has a limit on the distance it can travel at once.

The total accommodation expenses Takahashi can prepare is M yen. When selecting towns such that the total accommodation expenses of visited towns is at most M yen, find the maximum possible total profit.

Note that if no town is visited, the total profit is 0.

Constraints

- $1 \leq N \leq 200$
- $1 \leq M \leq 200$
- $1 \leq K \leq N$
- $1 \leq A_i \leq 10^9$
- $1 \leq B_i \leq M$
- All inputs are integers

Input

$N \quad M \quad K$
$A_1 \quad B_1$
$A_2 \quad B_2$
$:$
$A_N \quad B_N$

- The first line contains N representing the number of towns, M representing the total accommodation expenses available, and K representing the maximum number of towns that can be traveled at once, separated by spaces.
- From the 2nd line to the $(N+1)$-th line, information about each town is given.
  - The $(1+i)$-th line contains the profit A_i obtainable in the i-th town and the accommodation expense B_i, separated by spaces.

Output

Output in one line the maximum possible total profit when selecting towns that satisfy the conditions.

Sample Input 1 Copy

```
5 10 2
8 3
5 4
10 5
3 2
7 3
```

Sample Output 1 Copy

```
21
```

Sample Input 2 Copy

```
4 5 1
100 2
200 3
150 2
50 1
```

Sample Output 2 Copy

```
350
```

Sample Input 3 Copy

```
10 50 3
1000000000 10
500000000 8
800000000 12
300000000 5
600000000 15
900000000 20
400000000 7
700000000 11
200000000 6
550000000 9
```

Sample Output 3 Copy

```
3450000000
```

E - Temperature Fluctuation Range

Time Limit: 2 sec / Memory Limit: 1024 MiB

Score : 466 pts

Problem Statement

Takahashi is analyzing weather data. There is a record of temperature observations taken over N consecutive days in a certain region, where the temperature on day i was H_i degrees.

Takahashi wants to select a consecutive period of K days from this observation data and investigate the temperature variation range during that period.

Here, the "temperature variation range" for a consecutive period of K days is defined as the difference between the maximum temperature and the minimum temperature during that period.

Takahashi wants to find a consecutive period of K days that maximizes the temperature variation range. Find the maximum value of the temperature variation range.

Constraints

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

Input

$$
\begin{array}{llll}
N & K & & \\
H_1 & H_2 & \ldots & H_N
\end{array}
$$

- The first line contains N, representing the number of observation days, and K, representing the number of consecutive days to select, separated by a space.
- The second line contains $H_1, H_2, \ldots, H_N$, representing the temperature on each day, separated by spaces.

Output

Output the maximum value of the temperature variation range in one line.

Sample Input 1

Copy

```
5 3
2 5 1 8 4
```

Sample Output 1 Copy

```
7
```

Sample Input 2 Copy

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

Sample Output 2 Copy

```
13
```

Sample Input 3 Copy

```
12 5
100 -50 200 150 -100 300 50 -200 250 0 -150 400
```

Sample Output 3 Copy

```
600
```