Question 0 Enumeration (50 Marks)

Program Name:	PROGRAM0.EXE
Input:	Standard Input
Output:	Standard Output
Maximum Execution Time:	1 second

Write a program to read an integer N and output N^2 integers in specified format.

Input

The input contains an integer N ($1 \leq N \leq 10$).

Output

The output contains a triangle with its base at the left, of length $2N$-1. Every integer will be greater than the integer on the left by 1 and it will be greater than the integers above.

Sample Input

```
4
```

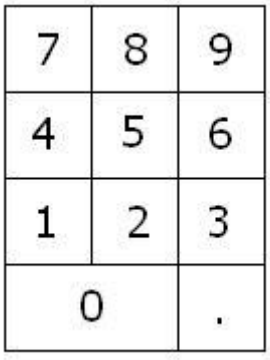
Sample Output

```
1
2 3
4 5 6
7 8 9 10
11 12 13
14 15
16
```

Question 1 Numpad (100 Marks)

Program Name:	PROGRAM1.EXE
Input:	Standard Input
Output:	Standard Output
Maximum Execution Time:	1 second

Green is a scientist who is studying the efficiency of pressing a numpad with only one finger.



The above figure shows the configuration of the numpad. It contains 11 keys including 10 digits and a "dot". Initially, the finger is on key 5. In each move, the user only moves his finger leftward, rightward, upward or downward by one square. The finger cannot be outside the numpad. For instance, if his finger is on key 5, it can only move to key 2, 4, 6 or 8 in the next move. Similarly, if his finger is on key 8, it can only move to key 5, 7 or 9 in the next move. The user can press on a key only when his finger is on that key. Also, Green only studies the finger movement, pressing is not considered as a move. Note that key 0 occupies 2 squares. It takes 1 move to move between the two squares. To type the digit 0, you need only to press on one of the squares of the key.

Since you are one of Green's best friends, write a program to output the minimum number of moves required to type a given number.

Input

The input consists of a single line with a positive integer N, which is less than 10^{30}.

Output

The output consists of a single integer representing the minimum number of moves to type N.

Sample Input 1

```
32767
```

Sample Output 1

```
12
```

Explanation 1

One of the possible movements:

5→ 6→ 3(press) → 2(press) → 1→ 4→ 7(press) → 4→ 5→ 6(press) → 9→ 8→ 7(press)

Sample Input 2

```
32207
```

Sample Output 2

```
8
```

Explanation 2

One of the possible movements:

5→ 6→ 3(press) → 2(press)(press) → right 0(press) → left 0→ 1→ 4→ 7(press)

Constraints

In 50% of the test cases,

- *N* will only consist of digits '4' to '9'.

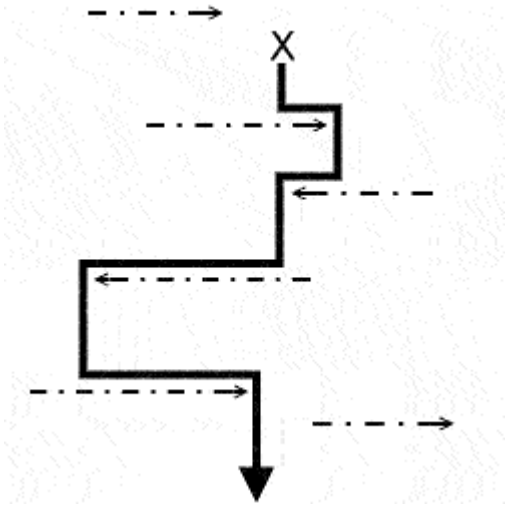
Question 2 Quest for Polar Bear (100 Marks)

Program Name:	PROGRAM2.EXE
Input:	Standard Input
Output:	Standard Output
Maximum Execution Time:	1 seconds

Your friend Green is an extreme environmentalist. He plans to walk to the Antarctica to study the living behaviour of polar bear. You spend an hour explaining to him that it is impossible to walk to the Antarctica, and there is no polar bear in the Antarctica. Therefore he agrees to buy a second-hand car. His plan is to keep driving towards the South until he reaches the South Pole. You are so tired of explaining to him that you just let him begin his funny journey.

The first challenge Green encounters is to leave his home town. There are *N* road segments in the town. The direction of the road segments are either to the East or to the West. Initially Green is driving from his house towards the South. He got a nice sport utility vehicle. Therefore he does not need to travel on roads. However, when Green enters a road segment (including its starting point and ending point), he must follow the direction of the road segment until he reaches the ending point of the road segment, then he will continue travelling towards the South. You may assume that no two roads have any common point, and Green's house is not on any road segment.

The following figure shows a possible configuration of road segments in the town. The road segments are represented by dotted lines, where the arrow indicates the direction. The house of Green is marked "X". The solid line indicates the path Green will travel along.



Green hates civilization, for instance, travelling on roads. As a friend of his, write a program to output the number of road segments he will visit.

Input

The first line contains three integers X_0, Y_0 and N, where (X_0, Y_0) are the coordinates of Green's house. We take east as the X-direction and north as the Y-direction.

Each of the following N lines contains three integers, Y_i, $X1_i$ and $X2_i$, where ($X1_i$, Y_i) are the coordinates of the starting point and ($X2_i$, Y_i) are the coordinates of the ending point of the i^{th} road.

The roads segments are given in increasing order of Y_i, then in increasing order of $X1_i$, then in increasing order of $X2_i$.

Output

The output contains a single integer, the number of road segments he will visit.

Sample Input

```
12 0 6
1 1 5
2 -6 -1
5 1 -4
8 4 0
10 -3 1
13 -5 -1
```

Sample Output

```
4
```

Constraints

In all the test cases,

- $1 \le N \le 200{,}000$
- $-10{,}000 \le X_0, Y_0, Y_i, X1_i, X2_i \le 10{,}000$

In 50% of the test cases,

- $1 \le N \le 1{,}000$

Question 3 Insect Galore (100 Marks)

Program Name:	PROGRAM3.EXE
Input:	Standard Input
Output:	Standard Output
Maximum Execution Time:	1 second

"How many Kinds Of Insect?" is a programme organized by insect enthusiasts to study the activity of insects. Unfortunately, insects now hibernate much longer than before due to global climate change. As hibernated insects cannot be observed, it now takes much more time to observe the various kinds of insects.
There are four kinds of insects:

1. **Bees**
   Bees are diligent insects that hibernates in alternate years starting in the year 2000. Their years of activity are 2001, 2003, 2005 etc.
2. **Cicadae**
   Cicadae are lazy insects that hibernates for 2 years after being active for 1 year. Their years of activity are 2002, 2005, 2008 etc.
3. **Beetles**
   Beetles are mighty insects that hibernates for 2 years after being active for 2 year. Their years of activity are 2001, 2002, 2005, 2006 etc.
4. **Butterflies**
   Butterflies are graceful yet mysterious insects that stay active for 1 year and hibernate for 1 year, then stay active for 1 year and hibernate for 2 years, then stay active for 1 year and hibernate for 3 years and so on. Their years of activity are 2001, 2003, 2006, 2010 etc.

As a participant of the programme and an insect lover, you would like to find the best year for insect observation. You know the number of insects of each kind. The programme starts in the year 2010, so you can only select the year 2010 or the years after it. Write a program to output the year in which the most number of insects can be observed. If there is more than one possible years, output the earliest year.

Input

The input consists of a single line containing 4 integers, *B*, *C*, *E* and *F*, separated by single spaces, representing the number of bees, cicadae, beetles and butterflies respectively.

Output

The output consists of 2 integers separated by a single space, the year selected and the maximum number of insects can be observed.

Sample Input

```
2 4 1 0
```

Sample Output

```
2017 7
```

Constraints

In all the test cases,

- $0 \leq B, C, E, F \leq 10{,}000$

In 50% of the test cases,

- $F = 0$

Question 4 Reading Books (100 Marks)

Program Name:	PROGRAM4.EXE
Input:	Standard Input
Output:	Standard Output
Maximum Execution Time:	1 seconds

There are *M* books in a library. In each week, *N* students labeled 1, ...,*N* ($M > N \geq 1$) take turn to perform a return-and-borrow procedure. In the procedure, a student first returns his borrowed book (if he has any), then borrows another available book. The students are now competing with each other on the total number of pages that they can read in *K* weeks ($K \geq 1$). The student who read the most total number of pages is the winner.

In each week, the student labeled 1 performs the procedure first, and then the student labeled 2 performs the procedure, and so on. No matter how many number of pages a book has, they can always finish the book in a week. Each student does not borrow the same book that he read last week since it is boring to read the same book again immediately. However, a student can still borrow and read the book that he returned a week or more ago.

It is assumed that for winning the competition, each student always borrows an available book with the largest number of pages. Please note that all the students have not borrowed any book initially.

Write a program to output the total number of pages read by the winner.

Input

The first line consists of 3 integers, *N*, *M* and *K*.
Each of the following *M* lines consists of a single positive integer less than 20000, representing the number of pages of a book. The numbers are sorted in ascending order.

Output

The output consists of a single integer, the total number of pages read by the winner in these *K* weeks.

Sample Input 1

```
3 4 2
2
3
4
10
```

Sample Output 1

```
14
```

Explanation 1

The 2nd student reads the most, 4 pages in the 1st week and 10 pages in 2nd week.

Sample Input 2

```
4 5 6
5
10
20
40
80
```

Sample Output 2

```
235
```

Explanation 2

The 1st student reads the most.

Constraints

In all the test cases,

- $1 \le N \le 30{,}000$
- $1 \le M \le 100{,}000$
- $0 \le K \le 100{,}000$

In 80% of the test cases,

- $1 \le N \le 3{,}000$
- $1 \le M \le 10{,}000$

In 50% of the test cases,

- $1 \le N \le 100$
- $1 \le M \le 1{,}000$