

## PROBLEM - EMPODIA

The ancient mathematician and philosopher Pythagoras believed that reality is mathematical in nature. Present-day biologists study properties of biosequences. A biosequence is a sequence of  $M$  integers, which

- contains each of the numbers  $0, 1, \dots, M-1$ ,
- starts with 0 and ends with  $M-1$ , and
- has no two elements  $E, E+1$  in adjacent positions in this order.

A subsequence consisting of adjacent elements of a biosequence is called a segment. A segment of a biosequence is called a framed interval if it includes all integers whose values are between the value of the first element, which must be the smallest element in the segment, and the last element, which must be the largest and different from the first. A framed interval is called an empodio if it does not contain any shorter framed intervals.

As an example, consider the biosequence  $(0, 3, 5, 4, 6, 2, 1, 7)$ . The whole biosequence is a framed interval. However, it contains another framed interval  $(3, 5, 4, 6)$  and therefore it is not an empodio. The framed interval  $(3, 5, 4, 6)$  does not contain a shorter framed interval, so it is an empodio. Furthermore, it is the only empodio in that biosequence.

You are to write a program that, given a biosequence, finds all empodia (plural for empodio) in that biosequence.

### INPUT

The input file name is `empodia.in`. The first line contains a single integer  $M$ : the number of integers in the input biosequence. The following  $M$  lines contain the integers of the biosequence in the order of the sequence. Each of these  $M$  lines contains a single integer.

### OUTPUTS

### OUTPUT

The output file name is `empodia.out`. The first line in this file is to contain one integer  $H$ : the number of empodia in the input biosequence. The following  $H$  lines describe all empodia of the input biosequence in the order of appearance of the starting point in the biosequence. Each of these lines is to contain two integers  $A$  and  $B$  (in that order) separated by a space, where the  $A$ th element of the input biosequence is the first element of the empodio and the  $B$ th element of the input biosequence is the last element of the empodio.

### EXAMPLE INPUTS AND OUTPUTS

`empodia.in`

```
8
0
3
5
1
```

`empodia.out`

```
1
2 5
```

4
6
2
1
7

**CONSTRAINS**

In one input,  $1000000 \leq M \leq 1100000$ . In all other inputs,  $1 \leq M \leq 60000$ .  
Additionally, in 50% of the inputs,  $M \leq 2600$ .

## PROBLEM - FARMER

A farmer has a set of fields, each of which is surrounded by cypress trees. Also, the farmer has a set of strips of land, each of which has a row of cypress trees. In both fields and strips, between every two consecutive cypress trees is a single olive tree. All of the farmer's cypress trees either surround a field or are in a strip and all of the farmer's olive trees are between two consecutive cypress trees in a field or in a strip.

One day the farmer became very ill and he felt that he was going to die. A few days before he passed away he called his eldest son and told him, "I give you any  $Q$  cypress trees of your choice and all the olive trees which are between any two consecutive cypress trees you have chosen." >From each field and from each strip the son can pick any combination of cypress trees. Since the eldest son loves olives he wants to pick the  $Q$  cypress trees which will allow him to inherit as many olive trees as possible.

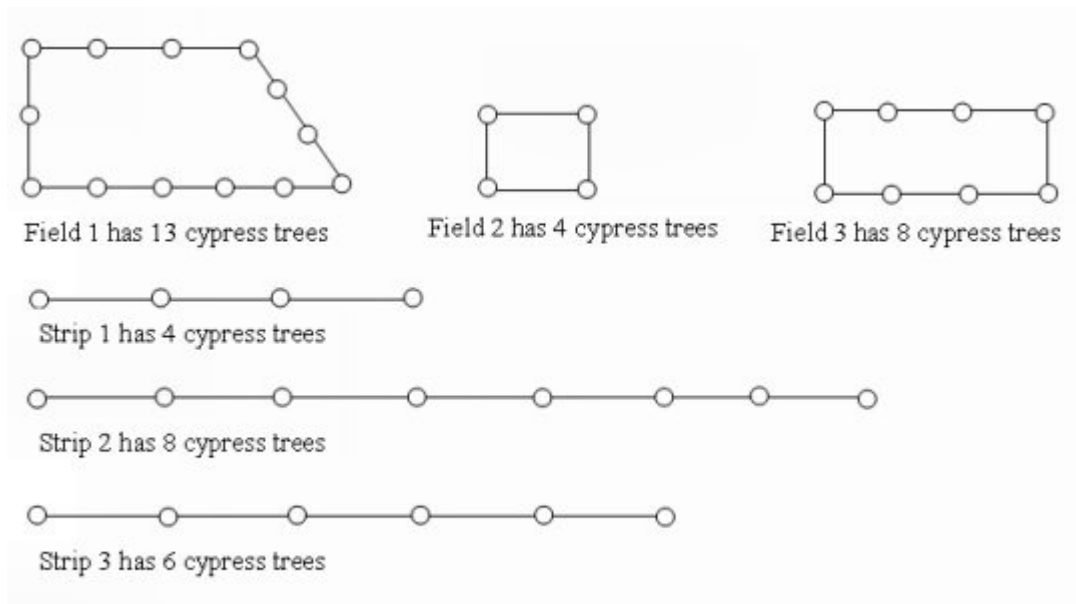


Figure 1. An example setting of cypress trees; olive trees are not shown.

In Figure 1, assume that the son is given  $Q=17$  cypress trees. To maximize his olive inheritance he should choose all the cypress trees in Field 1 and Field 2, inheriting 17 olive trees.

You are to write a program which, given the information about the fields and the strips and the number of cypress trees the son can pick, determines the largest possible number of olive trees the son may inherit.

## INPUT

The input file name is farmer.in. The first line contains first the integer  $Q$ : the number of cypress trees the son is to select; then the integer  $M$ , the number of fields; and then the integer  $K$ , the number of strips. The second line contains  $M$  integers  $N_1, N_2, \dots, N_M$ , : the numbers of cypress trees in fields. The third line contains  $K$  integers  $R_1, R_2, \dots, R_K$ : the numbers of cypress trees in strips.

## OUTPUT

The output file name is farmer.out. The file is to contain one line with one integer: the largest possible number of olive trees the son may inherit.

## EXAMPLE INPUTS AND OUTPUTS

hermes.in

```
5
17 3 3
13 4 8
4 8 6
```

hermes.out

```
17
```

## CONSTRAINTS

In all inputs,  $0 \leq Q \leq 150000$ ,  $0 \leq M \leq 2000$ ,  $0 \leq K \leq 2000$ ,  $3 \leq N_1 \leq 150$ ,  $3 \leq N_2 \leq 150, \dots, 3 \leq N_M \leq 150$ ,  $2 \leq R_1 \leq 150$ ,  $2 \leq R_2 \leq 150, \dots, 2 \leq R_K \leq 150$ . The total number of cypress trees in the fields and strips is at least  $Q$ .

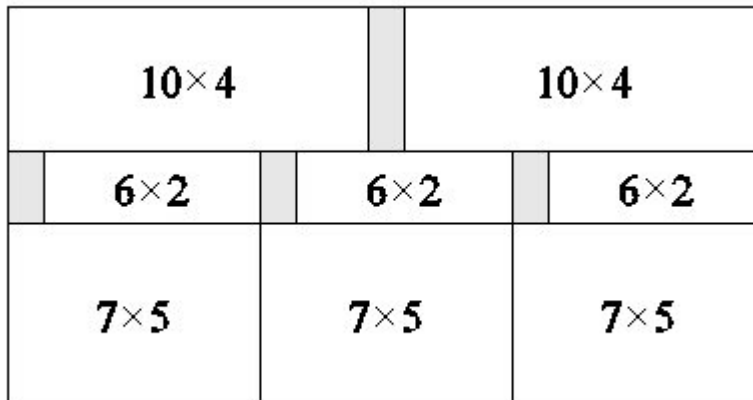
Additionally, in 50% of the inputs,  $Q \leq 1500$ .

## PROBLEM - PHIDIAS

Famous ancient Greek sculptor Phidias is making preparations to build another marvelous monument. For this purpose he needs rectangular marble plates of sizes  $W_1 H_1$ ,  $W_2 H_2$ , ...,  $W_N H_N$ .

Recently, Phidias has received a large rectangular marble slab. He wants to cut the slab to obtain plates of the desired sizes. Any piece of marble (the slab or the plates cut from it) can be cut either horizontally or vertically into two rectangular plates with integral widths and heights, cutting completely through that piece. This is the only way to cut pieces and pieces cannot be joined together. Since the marble has a pattern on it, the plates cannot be rotated: if Phidias cuts a plate of size  $A B$  then it cannot be used as a plate of size  $B A$  unless  $A = B$ . He can make zero or more plates of each desired size. A marble plate is wasted if it is not of any of the desired sizes after all cuts are completed. Phidias wonders how to cut the initial slab so that as little of it as possible will be wasted.

As an example, assume that in the figure below the width of the original slab is 21 and the height of the original slab is 11, and the desired plate sizes are  $10 \times 4$ ,  $6 \times 2$ ,  $7 \times 5$ , and  $15 \times 10$ . The minimum possible area wasted is 10, and the figure shows one sequence of cuts with total waste area of size 10.



Your task is to write a program that, given the size of the original slab and the desired plate sizes, calculates the minimum total area of the original slab that must be wasted.

### INPUT

The input file name is `phidias.in`. The first line of input contains two integers: first  $W$ , the width of the original slab, and then  $H$ , the height of the original slab. The second line contains one integer  $N$ : the number of desired plate sizes. The following  $N$  lines contain the desired plate sizes. Each of these lines contains two integers: first the width  $W_i$  and then the height  $H_i$  of that desired plate size ( $1 \leq i \leq N$ ).

### OUTPUT

The output file name is phidias.out. The file is to contain one line with a single integer: the minimum total area of the original slab that must be wasted.

### EXAMPLE INPUTS AND OUTPUTS

hermes.in

```
5
21 11
4
10 4
6 2
7 5
15 10
```

hermes.out

```
10
```

### CONSTRAINS

In all inputs,  $0 \leq Q \leq 150000$ ,  $0 \leq M \leq 2000$ ,  $0 \leq K \leq 2000$ ,  $3 \leq N1 \leq 150$ ,  $3 \leq N2 \leq 150, \dots 3 \leq NM \leq 150$ ,  $2 \leq R1 \leq 150$ ,  $2 \leq R2 \leq 150, \dots 2 \leq RK \leq 150$ . The total number of cypress trees in the fields and strips is at least  $Q$ .

Additionally, in 50% of the inputs,  $Q \leq 1500$ .

In all inputs,  $1 \leq W \leq 600$ ,  $1 \leq H \leq 600$ ,  $0 < N \leq 200$ ,  $1 \leq Wi \leq W$ , and  $1 \leq Hi \leq H$ .

Additionally, in 50% of the inputs,  $W \leq 20$ ,  $H \leq 20$  and  $N \leq 5$ .