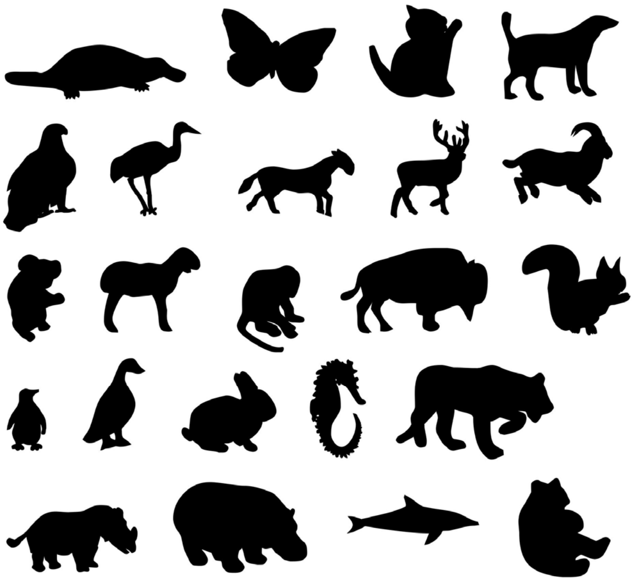
Problem A: Species

(blue balloon)

Time limit : 3 seconds



Alicia has a huge garden which is the habitat of many animals that she really cares about. After listening to a podcast about biodiversity, she becomes very concerned about the balance between species in her garden. She wants to know if there is a species that could overtake the others. In order to do so, she decides to carry out a census of all animals in the garden, writing down the species of each of them. Can you help her checking if there is strictly more animals from one species than the animals from all others species together?

Standard Input

The input consists of the following lines:

- on the first line: an integer N;
- on each of the next N lines: the species of an animal as a string of length at most 20, containing only ASCII alphanumeric characters.

Limits

- $1 \leq N \leq 2 * 10^5$.

Standard Output

A string that appears a number of times that is greater than the sum of the others, if there is any, or the string “NONE” otherwise.

Examples

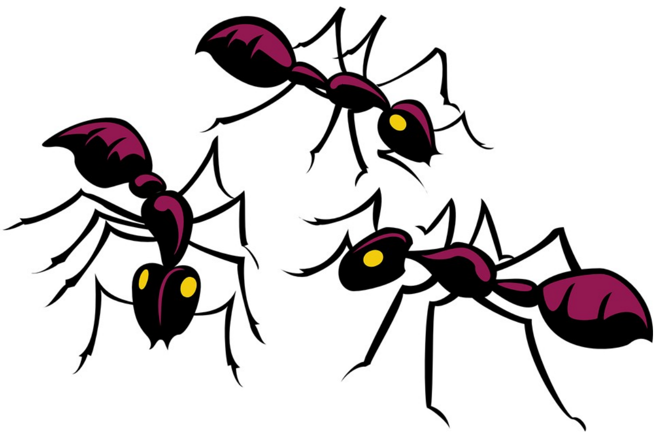
Sample Input	Sample Output
3 frog fish frog	frog

Sample Input	Sample Output
4 cat mouse mouse cat	NONE

Problem B: Charles

(red balloon)

Time limit : 2 seconds



Charles is fascinated by ants. In order to observe a colony of ants over a long period, Charles managed to build a program that uniquely identifies each ant, using image recognition. (Yes, every ant is unique.) Inside the program, each ant is tagged with a unique nonnegative integer. Whenever there is a birth in the colony, the new ant is given a new tag, different from all tags already assigned. Whenever some ant disappears, its tag falls back into the pool of available tags.

Charles's program works as follows. It first scans the whole colony, building the list of tags of the ants that are recognized. Then it assigns fresh tags to the new ants. To do so, the program simply picks the first natural number (i.e., nonnegative integer) that is not currently assigned to any ant, and so on. Due to some glitches in the image recognition device and in the program, there are sometimes negative or very large numbers that appear in the input list. These are simply ignored by Charles's program.

Your job is to reimplement the part of Charles's program that finds a fresh tag to assign to a new ant.

Standard Input

The input consists of the following lines:

- on the first line: an integer N;
- on the next N lines: some integers $X_1, \ldots, X_N$, one per line.

Limits

The input satisfies $0 \leq N \leq 10^6$. Each integer X_i has less than 100 digits.

Standard Output

The smallest natural number that does not belong to the set $\{X_1, . . . , X_N\}$.

Sample Input	Sample Output
5 1 -1 0 3 10	2

Problem C: Climate

(yellow balloon)

Time limit : 2 seconds

Tania is a marine biologist. Her goal is to measure the impact of climate change on the population of Macaroni penguins. As most species of penguins, Macaroni penguins live in the southern hemisphere, near Antarctica. Tania is primarily focused on the population of Macaroni penguins near the "Îles Nuageuses" (in English, "Cloudy Islands").

During summer, the ice around the islands melt and the islands becomes too small to host all the birds. Some penguins live on the icebergs floating around. For her study, Tania needs to measure the area of those icebergs.

Using satellite imagery and image recognition, Tania has obtained a map of the icebergs and your goal is to measure their area. The island studied by Tania is quite small and the Earth can locally be approximated as a flat surface. Tania's map thus uses the usual 2D Cartesian coordinate system, and areas are computed in the usual manner. . For instance, a rectangle parallel to the axes defined by the equations $x_1 \leq x \leq x_2$ and $y_1 \leq y \leq y_2$ has an area of $(x_2 - x_1) \times (y_2 - y_1)$.

In Tania's representation, an iceberg is a polygon represented by its boundary. For each iceberg Tania has noted the sequence of points $p_1, \ldots, p_k$ defining the border of the iceberg. The various icebergs never touch each other and they never overlap. Furthermore the boundary $p_1, \ldots, p_k$ of an iceberg is always a "simple" polygon, i.e. no two segments in $[p_1; p_2], \ldots, [p_k; p_1]$ cross each other.

Standard Input

The input consists of the following lines:

- on the first line, an integer N, describing the number of polygons;
- then N blocks of lines follow, each describing a polygon and composed of:
  - on the first line, an integer P, the number of points defining the polygon border,
  - on the next P lines, two space-separated integers x and y, the coordinates of each border point.

Limits

- The number N of polygons is such that $1 \leq N \leq 1\,000$.
- Each polygon is described by P points with $3 \leq P \leq 50$.
- All coordinates are such that $0 \leq x, y \leq 10^6$.

Standard Output

The output should contain a single integer: the total area rounded to the nearest integer below. In other words, the output should be a single line containing a single integer I such that the total area A of the polygons described in the input is comprised between I included and $I + 1$ excluded ($I \leq A < I + 1$).

Examples

Sample Input 1	Sample Output 1
1 4 0 0 1 0 1 1 0 1	1

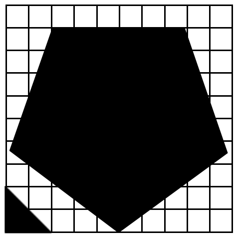
Sample Explanation 1

This sample has a unique iceberg, which is a square of side 1.

Sample Input 2	Sample Output 2
2 5 98 35 79 90 21 90 2 36 50 0 3 0 0 20 0 0 20	6100

Sample Explanation 2

In this sample (depicted on the right) there are two icebergs, a triangle of area 200 and a pentagon of area 5900.5.



Problem D: Lunar year (Orange balloon)

Time limit : 1 second

To celebrate the Lunar New Year of the Rat, Douglas decides to count the number of rats living in his area. It is impossible for him to find all rats, as they tend to be well hidden. However, on the first day of the new year, Douglas manages to capture n_1 rats, and marks each of them with an ear tag before releasing them. On the second day of the new year, Douglas captures n_2 rats, and observes that n_{12} of them had been marked during the first day.

Douglas is asking for your help to estimate the total number of rats in his area. Looking up in your statistics textbook, you propose using the Chapman estimator $\hat{N}$, given by:

$$\hat{N} := \left\lfloor \frac{(n_1+1)(n_2+1)}{n_{12}+1} - 1 \right\rfloor$$

where $\lfloor x \rfloor$ is the *floor* of a real number x, i.e., the closest integer less than or equal to x.

Standard Input

The input consists of a single line, with three space-separated integers: n_1, n_2, n_{12}, in that order.

Standard Output

The output should contain a single line with the single integer $\hat{N}$.

Limits

- $0 \leq n_1, n_2 \leq 10\,000$;
- $0 \leq n_{12} \leq \min(n_1, n_2)$.

Sample Input	Sample Output
`15 18 11`	`24`

Problem E : Birds

(purple balloon)

Time limit : 3 seconds

Kiara studies an odd species of birds which travel in a very peculiar way. Their movements are best explained using the language of graphs: there exists a directed graph $\boldsymbol{G}$ where the nodes are trees, and a bird can only fly from a tree T_a to T_b when (T_a, T_b) is an edge of $\boldsymbol{G}$.

Kiara does not know the real graph $\boldsymbol{G}$ governing the flight of these birds but, in her previous field study, Kiara has collected data from the journey of many birds. Using this, she has devised a graph $\boldsymbol{P}$ explaining how they move. Kiara has spent so much time watching them that she is confident that if a bird can fly directly from a to b, then she has witnessed at least one such occurrence. However, it is possible that a bird flew from a to b to c but she only witnessed the stops a and c and then added (a, c) to $\boldsymbol{P}$. It is also possible that a bird flew from a to b to c to d and she only witnessed a and d, and added (a, d) to $\boldsymbol{P}$, etc. To sum up, she knows that $\boldsymbol{P}$ contains all the edges of $\boldsymbol{G}$ and that $\boldsymbol{P}$ might contain some other edges (a, b) for which there is a path from a to b in $\boldsymbol{G}$ (note that $\boldsymbol{P}$ might not contain all such edges).

For her next field study, Kiara has decided to install her base next to a given tree T. To be warned of the arrival of birds on T, she would also like to install detectors on the trees where the birds can come from (i.e. the trees T' such that there is an edge (T', T) in $\boldsymbol{G}$). As detectors are not cheap, she only wants to install detectors on the trees T' for which she is sure that (T', T) belongs to $\boldsymbol{G}$.

Kiara is sure that an edge (a, b) belongs to $\boldsymbol{G}$ when (a, b) is an edge of $\boldsymbol{P}$ and all the paths in $\boldsymbol{P}$ starting from a and ending in b use the edge (a, b). Kiara asks you to compute the set $\boldsymbol{S(T)}$ of trees T' for which she is sure that (T', T) is an edge of $\boldsymbol{G}$.

Standard Input

The input describes the graph $\boldsymbol{P}$. The first line contains three space-separated integers N, M, and T: N is the number of nodes of $\boldsymbol{P}$, M is the number of edges of $\boldsymbol{P}$ and T is the node corresponding to the tree on which Kiara will install her base.

The next M lines describe the edges of the graph $\boldsymbol{P}$. Each contains two space-separated integers a and b ($0 \leq a, b < N$ and $a \neq b$) stating that $(a, b) \in \boldsymbol{P}$. It is guaranteed that the same pair (a, b) will not appear twice.

Limits

- $1 \leq N, M \leq 100\,000$;
- $0 \leq T < N$.

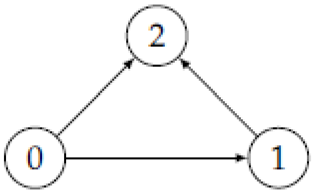
Standard Output

Your output should describe the set $\boldsymbol{S(T)}$. The first line should contain an integer L, which is the number of nodes in $\boldsymbol{S(T)}$, followed by L lines, each containing a different element of $\boldsymbol{S(T)}$. The elements of $\boldsymbol{S(T)}$ should be printed in increasing order, with one element per line.

Examples

Sample Input 1	Sample Output 1
3 3 2 0 1 0 2 1 2	1 1

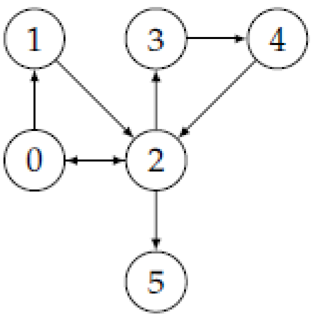
Sample Explanation 1



The graph corresponding to this example is depicted on the right. The node 1 belongs to **S(2)** because the (only) path from 1 to 2 uses (1, 2). The node 0 does not belong to **S(2)** because the path $0 \rightarrow 1 \rightarrow 2$ does not use the edge (0, 2).

Sample Input 2	Sample Output 2
6 8 2 0 1 0 2 1 2 2 0 2 3 3 4 4 2 2 5	2 1 4

Sample Explanation 2



The graph corresponding to this example is depicted on the right. For the same reason as in Sample 1, the node 0 does not belong to **S(2)** while 1 does. The nodes 3 and 5 do not belong to **S(2)** because we do not have edges (3, 2) or (5, 2). Finally 4 belongs to (2) because all paths from 4 to 2 use the edge (4, 2).