



**acm** International Collegiate  
Programming Contest

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# ACM International Collegiate Programming Contest 2016

Latin American Regional Contests

*November 11th-12th, 2016*

## Contest Session

*This problem set contains 11 problems; pages are numbered from 1 to 13.*

*This problem set is used in simultaneous contests hosted in the following countries:*

Argentina, Bolivia, Brasil, Chile, Colombia, Costa Rica, Cuba,  
México, Panamá, Perú, República Dominicana and Venezuela

## General information

Unless otherwise stated, the following conditions hold for all problems.

### Program name

1. Your solution must be called `codename.c`, `codename.cpp` or `codename.java`, `codename.py2`, `codename.py3`, where *codename* is the capital letter which identifies the problem.

### Input

1. The input must be read from standard input.
2. The input consists of a single test case, which is described using a number of lines that depends on the problem. No extra data appear in the input.
3. When a line of data contains several values, they are separated by *single* spaces. No other spaces appear in the input. There are no empty lines.
4. The English alphabet is used. There are no letters with tildes, accents, diaereses or other diacritical marks (ñ, Ã, é, Ì, ô, Ü, ç, etcetera).
5. Every line, including the last one, has the usual end-of-line mark.

### Output

1. The output must be written to standard output.
2. The result of the test case must appear in the output using a number of lines that depends on the problem. No extra data should appear in the output.
3. When a line of results contains several values, they must be separated by *single* spaces. No other spaces should appear in the output. There should be no empty lines.
4. The English alphabet must be used. There should be no letters with tildes, accents, diaereses or other diacritical marks (ñ, Ã, é, Ì, ô, Ü, ç, etcetera).
5. Every line, including the last one, must have the usual end-of-line mark.
6. To output real numbers, round them to the closest rational with the required number of digits after the decimal point. Test case is such that there are no ties when rounding as specified.

### Development team

*The following persons helped to develop the problem set by creating and improving statements, solutions, test cases and input and output checkers:*

Bruno Junqueira Adami, Brazil  
Fidel I. Schaposnik, Argentina  
Guilherme Albuquerque Pinto, Brazil  
Luis Fernando Dorelli de Abreu, Brazil  
Paulo Cezar Pereira Costa, Brazil  
Rafael Armando Garcia Gomez, Colombia  
Yonny Mondelo Hernández, Cuba

## Problem A – Assigning Teams

*Author:* Pablo Ariel Heiber, Argentina

Four friends are playing table tennis. Each of them has a skill level which is represented by an integer number: the higher the number, the better the player is.

The four friends want to form two teams of two players each. For the game to be more exciting, they want the skill level of the teams to be as close as possible. The skill level of a team is the sum of the skill levels of the players in that team.

Although they are very good table tennis players, these friends are not so good at other things, like Math or Computing. Can you help them find the smallest possible difference between the teams' skill levels?

### Input

The input consists of a single line that contains four integers  $A$ ,  $B$ ,  $C$  and  $D$ , representing the skill levels of the four players ( $0 \leq A \leq B \leq C \leq D \leq 10^4$ ).

### Output

Output a line with an integer representing the smallest difference between the skill levels for both teams.

<b>Sample input 1</b> 4 7 10 20	<b>Sample output 1</b> 7
<b>Sample input 2</b> 0 0 1 1000	<b>Sample output 2</b> 999
<b>Sample input 3</b> 1 2 3 4	<b>Sample output 3</b> 0

## Problem B – Back to the Future

*Author:* Bruno Junqueira Adami, Brazil

Doctor Emmet is working on a safer device to travel in time. He gathered  $N$  different and rare pieces of metal. Each piece may be compatible with some other different pieces. He has a complete list with  $M$  distinct pairs of compatible metals. Any pair of metals that is not on the list is incompatible.

In order for the device to work, he must choose a set of metals such that each of them is compatible with at least  $A$  others in that set. However, in order to preserve some balance, they must also be incompatible with at least  $B$  others in that set.

More metals mean more energy and a safer device. This is why Doctor Emmet needs your help, he wants to know the size of the largest set he can choose that meets these criteria.

### Input

The first line contains four integers  $N$ ,  $M$ ,  $A$  and  $B$ , representing respectively how many different pieces of metal exist ( $1 \leq N \leq 10^5$ ), how many compatibilities there are ( $1 \leq M \leq 10^5$ ) and the variables  $A$  and  $B$  described in the problem statement ( $0 \leq A, B < N$ ). The different metals are conveniently numbered from 1 to  $N$ . Each of the following  $M$  lines contains two integers  $X$  and  $Y$  corresponding to a pair of compatible metals ( $1 \leq X, Y \leq N$  with  $X \neq Y$ ). There are no repeated pairs in the input.

### Output

Output a line with one integer representing the size of the largest set of metals satisfying the requirements specified in the problem statement.

<b>Sample input 1</b> 3 1 1 0 1 2	<b>Sample output 1</b> 2
<b>Sample input 2</b> 3 1 1 1 1 2	<b>Sample output 2</b> 0
<b>Sample input 3</b> 7 12 2 2 1 2 2 3 3 1 4 5 5 6 6 4 3 4 7 1 2 7 3 7 4 7 5 7	<b>Sample output 3</b> 6

## Problem C – Counting Self-Rotating Subsets

*Author:* Pablo Ariel Heiber, Argentina

A set of points in the plane is *self-rotating* if there is a point  $P$ , *the center*, and an *angle*  $\alpha$ , expressed in degrees, where  $0 < \alpha < 360$ , such that the rotation of the plane, with center  $P$  and angle  $\alpha$ , maps every point in the set to some point also in the set.

You are given a set of  $N$  distinct points, all having integer coordinates. Find the number of distinct subsets of size  $1, 2, \dots, N$  that are self-rotating. Two subsets are considered distinct if one contains a point that the other does not contain.

### Input

The first line of the input contains one integer  $N$  representing the number of points in the input set ( $1 \leq N \leq 1000$ ). Each of the following  $N$  lines describes a different point of the set, and contains two integers  $X$  and  $Y$  giving its coordinates in a Cartesian coordinate system ( $-10^9 \leq X, Y \leq 10^9$ ). All points in the input set are distinct.

### Output

Output a single line containing  $N$  integers  $S_1, S_2, \dots, S_N$ . For  $i = 1, 2, \dots, N$  the integer  $S_i$  must be the number of subsets of  $i$  points of the input set that are self-rotating. Since these numbers can be very big, output them modulo  $10^9 + 7$ .

<p><b>Sample input 1</b></p> <pre>3 1 1 2 2 1 0</pre>	<p><b>Sample output 1</b></p> <pre>3 3 0</pre>
<p><b>Sample input 2</b></p> <pre>7 -2 0 -1 1 0 2 0 0 2 0 1 -1 0 -2</pre>	<p><b>Sample output 2</b></p> <pre>7 21 5 5 3 1 1</pre>
<p><b>Sample input 3</b></p> <pre>1 -1000000000 1000000000</pre>	<p><b>Sample output 3</b></p> <pre>1</pre>

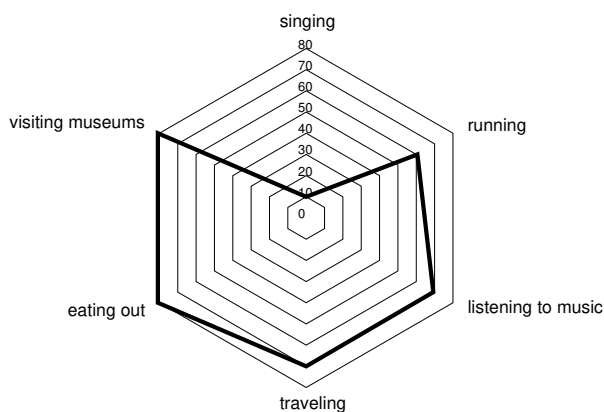
## Problem D – Dating On-Line

*Author:* Rafael Garcia Gomes, Colombia

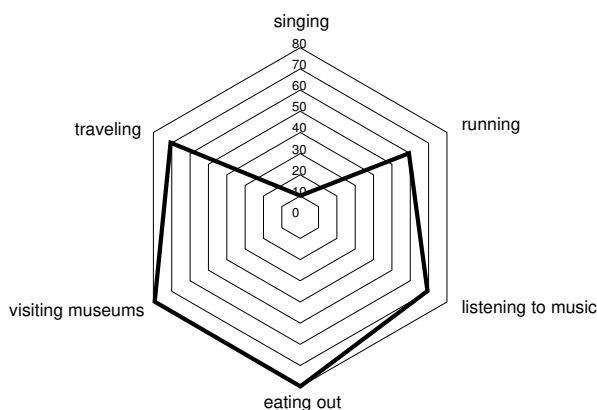
Alex registered in an online dating system to search for the perfect partner. The system requires each of its members to fill a form specifying how much they enjoy  $N$  different activities, grading them on a scale from 0 to 100. To present this information to potential dates, the system creates a profile featuring a special kind of polygon called “radial diagram”.

A radial diagram for  $N$  activities is drawn by marking  $N$  points on the plane. Starting from the vertical direction, the  $i$ -th point in clockwise order represents the  $i$ -th activity specified by the member, and is a distance  $S_i$  away from the center of the diagram, where  $S_i$  is the score given by the member for the corresponding activity. The angle sustained at the center of the diagram from each pair of consecutive points is always the same, and the polygon is formed by drawing the segments whose endpoints are consecutive points. Note that for the purposes of the radial diagram, the first and last points are considered to be consecutive.

For example, if  $N = 6$  Alex might specify the following activities: singing with score  $S_1 = 10$ , running with score  $S_2 = 60$ , listening to music with score  $S_3 = 70$ , traveling with score  $S_4 = 70$ , eating out with score  $S_5 = 80$ , and visiting museums with score  $S_6 = 80$ . Then the corresponding radial diagram would be as shown in the figure below.



The area of a radial diagram depends on the order in which the different activities are specified, and Alex suspects that a profile depicting a radial diagram with greater area might be more successful. For example, the radial diagram in the following figure features the same activities and scores as the example above, but has a greater area.



Alex has asked you to write a program to find the maximum possible area of a radial diagram given a list of activities graded with scores between 0 and 100.

### Input

The first line contains an integer  $N$  representing the number of activities ( $3 \leq N \leq 10^5$ ). The second line contains  $N$  integers  $S_1, S_2, \dots, S_N$  representing the scores given by Alex to each activity ( $0 \leq S_i \leq 100$  for  $i = 1, 2, \dots, N$ ).

## Output

Output a line with a rational number representing the maximum possible area of a radial diagram featuring the scores given in the input. The result must be output as a rational number with exactly 3 digits after the decimal point, rounded if necessary.

<b>Sample input 1</b> 6 10 60 70 70 80 80	<b>Sample output 1</b> 10002.593
<b>Sample input 2</b> 3 100 100 100	<b>Sample output 2</b> 12990.381
<b>Sample input 3</b> 7 16 37 50 35 12 39 24	<b>Sample output 3</b> 2772.765

## Problem E – Emission Spectrum

*Author:* Nico Lehmann, Chile

Scientists at the Interstellar Consortium of Planets and Constellations (ICPC) are studying the composition of many celestial objects by analyzing their *emission spectrum*. The emission spectrum of a celestial object is the spectrum of frequencies of electromagnetic radiation emitted due to its atomic energy transitions, along with the intensity of the emitted radiation. In other words, it corresponds to the intensity of each color for the light radiated by the object.

According to the postulates of quantum mechanics, the emission spectrum of a celestial object is always discrete. Therefore, the ICPC can store the emission spectrum of an object as a sequence of integers where each position in the sequence corresponds to the intensity of a specific wavelength. In this representation of the spectrum, larger numbers correspond to higher emitted intensities, and contiguous positions in the sequence correspond to contiguous wavelengths in the spectrum.

The emission spectrum of a celestial object is the result of very complex physical processes, and may thus vary through its lifetime. Notably, due to complex atomic reactions not yet fully understood, the intensity of two contiguous wavelengths can be swapped at a given time.

The ICPC is studying very closely the emission spectrum of some celestial object at particular wavelengths. However, scientists are having trouble obtaining useful data from their observations. Particularly, given a range of wavelengths and an integer  $K$ , they are interested in knowing the intensity of the wavelength which has the  $K$ -th smallest intensity in that range. Given a list of observational events mixing information requested by the scientists and wavelength intensity swaps in the spectrum, your task is to help the scientists by answering their queries.

### Input

The first line contains two integers  $N$  and  $Q$ , representing the number of measured wavelengths and the number of events, respectively ( $1 \leq N, Q \leq 10^5$ ). The second line contains  $N$  integers  $I_1, I_2, \dots, I_N$ , representing  $I_i$  the initial intensity of the  $i$ -th wavelength ( $0 \leq I_i \leq 10^9$  for  $i = 1, 2, \dots, N$ ). Each of the following  $Q$  lines corresponds to an event, and starts with a character representing the event type. If the event corresponds to a query from the ICPC scientists, the character is a ‘Q’; if it corresponds to an atomic swap reaction it is an ‘S’. Query events have three integers  $A, B$  and  $K$  after the ‘Q’ character, representing that the scientists are interested in the  $K$ -th smallest intensity in the range from  $A$  to  $B$ , inclusive ( $1 \leq A \leq B \leq N$  and  $1 \leq K \leq B - A + 1$ ). Intensity swapping events have a single integer  $W$  after the ‘S’ character, representing that the intensities for wavelengths at positions  $W$  and  $W + 1$  in the spectrum are swapped ( $1 \leq W \leq N - 1$ ).

### Output

Output one line for each query event in the input, containing a single integer number representing the intensity of the wavelength with the  $K$ -th smallest intensity in the range of the spectrum from  $A$  to  $B$ , inclusive (where  $A, B$  and  $K$  are the parameters specified in the corresponding query). Queries should be answered in the same order in which they appear in the input.

<p><b>Sample input 1</b></p> <pre>10 4 1 2 6 7 5 8 9 3 0 4 Q 1 10 7 Q 2 5 2 S 5 Q 2 5 2</pre>	<p><b>Sample output 1</b></p> <pre>6 5 6</pre>
<p><b>Sample input 2</b></p> <pre>4 3 33333333 22222222 44444444 11111111 Q 3 3 1 S 1 Q 2 4 2</pre>	<p><b>Sample output 2</b></p> <pre>44444444 33333333</pre>

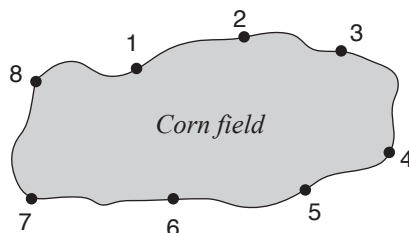


## Problem F – Farm robot

*Author:* Ricardo Anido, Brazil

To discourage birds such as crows and sparrows from feeding on his crops a farmer needed to put some scarecrows in his corn field. His nephew really likes robots, and suggested that he should use a robot scarecrow instead: “A single robot scarecrow can better protect the whole corn field and will last way more than ten traditional ones!”, he said.

Since the farmer thinks his nephew is a smart boy, he took his advice and bought a robot scarecrow. The robot moves along a pathway that surrounds the corn field. In the pathway there are  $N$  unmanned charging stations, numbered sequentially in clockwise order starting from 1. The figure below shows an example with eight charging stations.



The robot begins every day at station number 1, and is issued a sequence of commands that are to be performed in order during the day. These commands are generated based on advanced machine learning algorithms that work on data collected by sensors spread through the corn field, ensuring an optimal coverage of the crop. Each command results in the robot moving to another charging station next to the one it is currently at, either in clockwise or counter-clockwise direction.

Despite the promises of optimal coverage by the robot, at the end of a certain day the farmer found part of his crop devastated. To figure out what might have happened the farmer wants to know how many times the robot was at the charging station closest to the devastated area. Given the number of the station closest to the devastated area and the sequence of commands for a single day, can you help the farmer find this number?

### Input

The first line contains three integers  $N$ ,  $C$  and  $S$  representing respectively the number of posts ( $2 \leq N \leq 100$ ), the number of commands ( $1 \leq C \leq 1000$ ) and the charging station closest to the devastated area ( $1 \leq S \leq N$ ). The second line contains  $C$  integers  $X_1, X_2, \dots, X_C$ , representing the sequence of commands received by the robot scarecrow. For  $i = 1, 2, \dots, C$ , if  $X_i$  is 1 then the  $i$ -th command means “move to the next charging station in clockwise order”, whereas if  $X_i$  is  $-1$  then the  $i$ -th command means “move to the next charging station in counter-clockwise order”. The robot always starts at station number 1.

### Output

Output a line with an integer representing the number of times the robot was at station number  $S$  during the day.

<p><b>Sample input 1</b></p> <p>8 8 3 1 -1 1 1 1 1 -1 1 1</p>	<p><b>Sample output 1</b></p> <p>2</p>
<p><b>Sample input 2</b></p> <p>5 4 1 1 1 1 1</p>	<p><b>Sample output 2</b></p> <p>1</p>
<p><b>Sample input 3</b></p> <p>2 1 1 1</p>	<p><b>Sample output 3</b></p> <p>1</p>

<b>Sample input 4</b> 2 1 2 1	<b>Sample output 4</b> 1
<b>Sample input 5</b> 2 2 1 -1 1	<b>Sample output 5</b> 2
<b>Sample input 6</b> 2 2 1 -1 -1	<b>Sample output 6</b> 2

## Problem G – Game of Matchings

*Author:* Luís Fernando Dorelli de Abreu, Brazil

Adam and Carol are having a great time playing the Game of Matchings. The game is played on a string  $S$  composed of  $|S|$  lowercase English letters,  $s_1s_2\dots s_{|S|}$ . The goal is to find all matchings of a special kind of pattern  $P$  in  $S$ . The pattern has length  $N$  and is defined by a sequence of integers between 1 and 26.

We consider a contiguous substring  $s_i s_{i+1} \dots s_{i+N-1}$  starting at position  $i$  of  $S$  a matching of pattern  $P$  if there is a mapping from the numbers in  $P$  to lowercase English letters such that the pattern is mapped to  $s_i s_{i+1} \dots s_{i+N-1}$  but no two distinct numbers are mapped to the same letter.

For instance, if  $S$  is "awawww" and  $P$  is [10, 21, 10], the matchings of  $P$  are the substrings of  $S$  of length three starting at positions 1 and 2: "awa" and "waw". Note that "www" is not an occurrence because pattern numbers 10 and 21 would both map to 'w'.

Adam and Carol lost the answer sheet and are not sure if they are finding all occurrences for some of the strings in the game. Given  $S$  and  $P$  can you find the number of matchings for them?

### Input

The first line contains a non-empty string  $S$  of at most  $5 \times 10^5$  characters. Each character of  $S$  is a lowercase English letter from 'a' to 'z'. The second line contains an integer  $N$  representing the size of the pattern ( $1 \leq N \leq |S|$ ). The third line contains  $N$  integers  $P_1, P_2, \dots, P_N$  denoting the pattern ( $1 \leq P_i \leq 26$  for  $i = 1, 2, \dots, N$ ).

### Output

Output a line with one integer representing the number of matchings of  $P$  found in  $S$ .

<b>Sample input 1</b> awawww 3 10 21 10	<b>Sample output 1</b> 2
<b>Sample input 2</b> abcdefghij 10 1 2 3 4 5 6 7 8 9 1	<b>Sample output 2</b> 0
<b>Sample input 3</b> abbabaabbaababba 4 1 2 2 1	<b>Sample output 3</b> 5
<b>Sample input 4</b> aabcddabccceffkkgem 5 10 10 3 14 9	<b>Sample output 4</b> 4

## Problem H – Hotel Rewards

*Author:* Fidel I. Schaposnik, Argentina

You are planning to spend your holidays touring Europe, staying each night in a different city for  $N$  consecutive nights. You have already chosen the hotel you want to stay in for each city, so you know the price  $P_i$  of the room you'll be staying at during the  $i$ -th night of your holidays, for  $i = 1, \dots, N$ .

You will book your accommodation through a website that has a very convenient rewards program, which works as follows. After staying for a night in a hotel you booked through this website you are awarded one point, and at any time you can exchange  $K$  of these points in your account for a free night in any hotel (which will however not give you another point).

For example, consider the case with  $N = 6$  and  $K = 2$  where the prices for the rooms are  $P_1 = 10$ ,  $P_2 = 3$ ,  $P_3 = 12$ ,  $P_4 = 15$ ,  $P_5 = 12$  and  $P_6 = 18$ . After paying for the first four nights you would have four points in your account, which you could exchange to stay for free the remaining two nights, paying a total of  $P_1 + P_2 + P_3 + P_4 = 40$  for your accommodation. However, if after the first three nights you use two of the three points you earned to stay the fourth night for free, then you can pay for the fifth night and use the final two points to get the sixth one for free. In this case, the total cost of your accommodation is  $P_1 + P_2 + P_3 + P_5 = 37$ , so this option is actually more convenient.

You want to make a program to find out what the minimum possible cost for your holidays' accommodation is. You can safely assume that all hotels you want to stay always will have a room available for you, and that the order of the cities you are going to visit cannot be altered.

### Input

The first line of input contains two integers  $N$  and  $K$ , representing the total number of nights your holidays will last, and the number of points you need in order to get a free night ( $1 \leq N, K \leq 10^5$ ). The second line contains  $N$  integers  $P_1, P_2, \dots, P_N$ , representing the price of the rooms you will be staying at during your holidays ( $1 \leq P_i \leq 10^4$  for  $i = 1, 2, \dots, N$ ).

### Output

Output a line with one integer representing the minimum cost of your accommodation for all of your holidays.

<b>Sample input 1</b> 6 2 10 3 12 15 12 18	<b>Sample output 1</b> 37
<b>Sample input 2</b> 6 1 10 3 12 15 12 18	<b>Sample output 2</b> 25
<b>Sample input 3</b> 5 5 1 2 3 4 5	<b>Sample output 3</b> 15

## Problem I – Internet Trouble

*Author:* Pablo Ariel Heiber, Argentina

The government is planning to provide internet to people in remote areas, in this case small towns that developed on the side of a long and busy highway. There are  $N$  towns located side by side along the highway, each taking up exactly one kilometer of highway. The towns are numbered consecutively along the highway from 1 to  $N$ . To provide an internet connection, the government is going to place access-point stations with satellite links, which will provide wired connections for the towns.

The stations are to be placed in one or more different towns, being  $B$  the cost to build each station. Since the government wants to provide extremely good service, each house will be connected directly to one of these stations. When connecting a house in town  $i$ , we must choose a station in town  $j$  for connecting that house. The connection cost is then  $|i - j| \times C$ , where  $C$  is the cost of a kilometer of cable. Notice that the intra-town cable cost is small enough to be ignored, so in particular houses in a town where a station is placed do not incur in any cabling cost when connected to that station.

Given  $N$ ,  $B$ ,  $C$  and the number of houses in each town, write a program to determine the minimum total cost of providing an internet connection for every house in every town, including the cost of building the stations and laying the cabling for each house. Because the government hasn't decided yet on the final number of access-point stations to be built, you should calculate the minimum cost when there are 1, 2, ...,  $N$  stations.

### Input

The first line contains three integers  $N$ ,  $B$  and  $C$  representing the number of towns, the cost of building one access-point station and the cost of one kilometer of cable, respectively ( $1 \leq N \leq 6000$ ,  $1 \leq B \leq 10^9$  and  $1 \leq C \leq 100$ ). The second line contains  $N$  integers  $H_1, H_2, \dots, H_N$ , where  $H_i$  represents the number of houses in the  $i$ -th town ( $1 \leq H_i \leq 10^9$  for  $i = 1, 2, \dots, N$ ).

### Output

Output a line with  $N$  integers representing the minimum total cost of providing an internet connection for every house in every town when building 1, 2, ...,  $N$  access-point stations.

<p><b>Sample input 1</b></p> <pre>5 6 1 1 2 3 4 5</pre>	<p><b>Sample output 1</b></p> <pre>21 20 22 25 30</pre>
<p><b>Sample input 2</b></p> <pre>6 8 1 9 10 3 2 7 6</pre>	<p><b>Sample output 2</b></p> <pre>69 36 35 37 42 48</pre>

## Problem J – Just in Time

*Author:* Bruno Junqueira Adami, Brazil

Hello contestant, I want to play a game. Your coach is in the contest room with a bomb about to explode in his hands. This bomb will be set to detonate in  $T$  seconds, and if it detonates in the contest room it is going to explode only your team's balloons.

I can tell you that the contest room is inside a building that contains  $N$  rooms in total. From each room there is exactly one direct tunnel to another room, which can only be used in one direction. For example if room  $A$  connects to room  $B$ , then you can walk from room  $A$  to room  $B$ , but not from room  $B$  to room  $A$ , unless of course room  $B$  has a direct tunnel to room  $A$ .

The bomb has a special mechanism that detects if your coach stops moving, and if so it immediately triggers the detonation taking all your team's balloons down. For that reason your coach will constantly walk between the rooms, taking exactly one second to move through each tunnel. The only way for your team to save its balloons is for your coach not to be in the contest room when the bomb detonates.

You don't have the building map in hand, all I can tell you is that the tunnels are chosen uniformly at random. However, I will give you the possibility to set  $T$ , which must be an integer between 2 and  $N$  inclusive. Your job is to choose  $T$  in such a way that it maximizes your balloons' chance to survive this riddle.

Let the game begin.

### Input

The input consists of a single line that contains one integer  $N$ , representing how many rooms there are in the building ( $2 \leq N \leq 10^9$ ).

### Output

Output a line with one integer representing the value of  $T$  that maximizes your balloons' chance to survive the riddle.

<b>Sample input 1</b> 3	<b>Sample output 1</b> 3
<b>Sample input 2</b> 12	<b>Sample output 2</b> 11

## Problem K – Kill the Werewolf

*Author:* Luis Fernando Dorelli de Abreu, Brazil

In the popular board game *One Night Werewolf*, players are distributed randomly in the roles of villagers and Werewolves. The goal of the villagers is to decide together on one person to kill during the night – hopefully they will kill a Werewolf. Werewolves pose as villagers in the hope that the person killed is a villager, not a Werewolf.

In the variation *Uncertain Werewolf*, only one Werewolf exists and the game consists of two phases. During the first phase the players are still uncertain about who they should vote to kill, so each of them chooses two other players as possible victims. After the first phase the Werewolf reveals himself, and then in the second phase each player has to decide which one of their two initial choices they will vote to kill. The Werewolf is the last one to decide between his two initial choices, doing so after all the other players have decided already.

The Werewolf then loses the game if he has more votes than anyone else. If there is a draw, the Werewolf wins.

You are given the votes of  $N$  players after the first phase of the game. You should answer how many players could reveal themselves at this point as the Werewolf and still win the game if the other players chose their votes optimally to kill the Werewolf.

### Input

The first line contains an integer  $N$  ( $3 \leq N \leq 50$ ), the number of players in the game. Each of the following  $N$  lines contains two integers,  $a_i$  and  $b_i$  ( $1 \leq a_i, b_i \leq N$ ,  $a_i \neq b_i$ ), the index of the players the  $i$ -th player decided to kill in the first voting phase. No player will try to kill himself.

### Output

Output a line with one integer representing the number of players that could win the game if they were the Werewolf and everyone played optimally.

<p><b>Sample input 1</b></p> <pre>5 3 4 1 3 2 4 1 3 2 3</pre>	<p><b>Sample output 1</b></p> <pre>4</pre>
<p><b>Sample input 2</b></p> <pre>4 3 4 1 4 4 1 3 1</pre>	<p><b>Sample output 2</b></p> <pre>2</pre>