

PROGRAMMING COMPETITION

SPRING 2014

ARIZONA STATE UNIVERSITY – WOMEN IN COMPUTER
SCIENCE

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Problem 1

Matching Ransom

A detective found a ransom note created using letters from a magazine article. A ransom note is a phrase, whereas a magazine article is a full sentence. Words can repeat in both the ransom note and magazine. The detective wants to determine if it is possible to create the ransom note using the letters from the magazine. Help the detective by determining if the ransom note can be created from the magazine.

Description of Input

Input contains two lines. First line is the magazine (longer sentence) and the second line is the ransom note (phrase).

Description of Output

Output should be:

- **if** random note is matched with the magazine – *Possible*
- **else** – *Not Possible*.

Sample Case

Input

*How can we expect moms to order enough baby formula?
Come home*

Output

Possible

Problem 2

Collect Sheets of Papers

Alex is a lazy lawyer whose office is very untidy. Alex wanted to be more active and wanted somebody to help him sharpen his mind, so he hired a personal assistant to work along with him. To help challenge Alex, the personal assistant always keeps stacks of paper sheets on Alex's table of different sizes. Each day, Alex has to type a legal notice that should be of exactly x pages long. There are n stacks of paper sheets on his desk. Each stack does not necessarily has the same number of sheets of paper. One sheet of paper is considered *exactly* one page. Since he wanted to improve this mathematical abilities, Alex wanted to combine **only two** stacks which, when combined, will give exactly x sheets for his legal notice. What are the possible combinations of two stacks of papers that Alex can combine to get exactly x sheets of paper?

Description of Input

Input consists of the ' n ' number of stacks on the table ($2 < n < 100$). This is followed by the number of sheets present in each stack x_1, x_2, \dots, x_n where, x_i is the number of sheets present in the i th stack. Next input is the ' x ' number of pages a legal notice should contain.

Description of Output

Print all possible combinations of *stack ids* (which are the indices of the numbers in the array) whose total sum of sheets present in both these locations is equal to x . Each pair should be in different lines separated by a comma. If there is no possible combination, you should print *Not Possible*.

Sample Case

Input

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

Output

```
0 3
1 2
```


Problem 3

Zig-zag Flower Decoration

Mary is planning her daughter's birthday party for all her family and friends. She wants to decorate the dining table with flowers in a zig-zag fashion to make it look more beautiful and creative. Her thoughts on arranging these flower bunches is in such a way that she wants to keep a bunch of flowers at the far end location and at the next location she wants to put another bunch with less number of flowers compared to the previous bunch. This is followed by another bunch of flowers with more number of flowers compared to the previous bunch. This gives her a pattern of $f_1 > f_2 < f_3 > f_4 < f_5 > \dots$ where f_i is the bunch of flowers in the i^{th} position on the dining table.

She makes the flower bunches in a random fashion from the total flowers she has purchased, where each bunch can contain any number of flowers. It is *not necessary* that there are exactly same number of flowers in all the bunches. We should help Mary to figure out if these random bunches she made will follow the decoration pattern she wanted or not. If it is possible, in what way can she arrange these bunches?

Description of Input

There are two lines of input. The first line consists of the total number of bunches (n) Mary made and the second line contains the number of flowers in each bunch (n_i).

Description of Output

The number of lines of output should be equal to the total number of different possible arrangements of flower bunches. Each line should be the decoration pattern in terms of the number of flowers present in each bunch. If there is no possible combination, you should print *Not Possible*.

Sample Case

Input

```
4
1 3 3 4
```

Output

```
3 1 4 3
```


Problem 4

Pack the Boxes

Karen is moving to a new house and she wants to efficiently pack the different sized plastic storage boxes in her kitchen. These boxes are of decreasing size and can be placed one inside the other. In a set of boxes, the bigger box contains a smaller box which in turn contains another smaller box and so on. She wants to save space and time while packing these boxes, but the sets of boxes are all taken apart and are making a mess in her cabinets. So, she needs your help in telling her how to re-pack the boxes. There are n boxes of different sizes and right now they are in the shelf next to each other. The sizes are integers. Here are some of the rules she wants you to follow when you pack the boxes. You don't have any idea about the total number of box sets or the number of boxes in each set.

- You can put a box or a nested group of boxes only inside a larger box.
- You can combine two groups of boxes only if they are adjacent in the row.
- Once a box becomes a member of a group, it cannot be transferred to another group or permanently separated from the group. It can be temporarily separated only when combining two groups.

Since Karen wants you to quickly help her pack the boxes, you have to do this reassembly process as quickly as possible. The only time-consuming part of this task is opening and subsequently closing a box, so you want to minimize how often you do this. For example, the minimum number of openings (and subsequent closings) when combining group $[1,2,6]$ with the group $[4]$ is 2, since you have to open the boxes with sizes 6 and 4. When combining group $[1,2,5]$ with the group $[3,4]$ you need to perform 3 openings. Determine the minimum number of openings that are required to combine all the disassembled box sets.

Description of Input

There are two lines of input. On the first line you have the number n ($1 \leq n \leq 500$) which is the total number of boxes Karen has on her kitchen shelf. The second line of input contains n positive integers specifying the sizes of boxes in the order they appear on the shelf in a row.

Description of Output

Output should display the minimum number of openings required when reassembling the box sets. If the reassembling cannot be done, you should print *Not Possible*.

Sample Case

Input

8
4 2 3 1 3 2 4 1

Output

9

Problem 5

Breaking Half!!

Breaking Half is the name of a system you are hired to build. The main aim of the system is to break a given number into two portions with exactly same number of digits in each portion. Also, these two portions can be merged and arranged in a certain order to obtain the original given number. One important constraint is that the multiplication of these two numbers should be equal to the original number. It is up to you to find the algorithm used in building Breaking Half.

Description of Input

Input consists of a single line which is the number the system has to break into two numbers whose product is equal to this given number.

Description of Output

Output consists of two numbers which satisfy Breaking Half's requirements. If there is no possible combination, you should print *Not Possible*.

Sample Case

Input

1260

Output

21 60

Problem 6

Largest Spread

There is a small town in the north-eastern part of United States which has very low temperatures. Every year the region is very badly affected with the flu. The town council wanted to identify certain badly affected regions in the town to take precautions for the next year so that the spread of the flu can be reduced. The town council needs your help to detect the largest portion of the town affected by the flu last year.

The whole town is a rectangular shape and is divided into several different blocks of same area. You can express this region in the form of a matrix where there are m rows and n columns representing m horizontal and n vertical streets respectively. The area of this city is $m*n$ where each block is of one *mile*². In the matrix, the representation is as follows:

- 1, if the particular block of the city is affected with the flu,
- Otherwise, 0.

A particular block of the city is represented as the $(i, j)^{th}$ position in the matrix. The region needs your help in identifying the biggest block region affected in the town. Determine the area in square miles of the largest *rectangular* region affected by flu.

Description of Input

The first two lines of input each contain a single number. The first number represents the m rows and the second number represents the n columns. Then there are $m*n$ lines followed by these two lines representing the strings of 1's and 0's.

Description of Output

Output consists of the area of the largest rectangular region affected by flu in square miles.

Sample Case

Input

3
5
01110

01111
00101

Output
6

Problem 7

Mining for Gold

Once a greedy miser was very upset about how little fortune he made in his life so far. He heard from his neighbors that there is a deserted house in the town's outskirts which had gold under the floor. But, nobody knows if this is just a rumor or a fact as people are scared to enter that house. Even though the miser is scared of such deserted places, he risked his life to find gold and become rich. So, the miser started his journey and reached the house to find the gold.

Upon entering the house, the miser ended up in a huge rectangular hall with four entrances, one in each corner, and he stood at one of them. The length of the hall is n and the width of the hall is m where both are measured in tiles. The floor was paved with white square tiles. He started searching for the gold by turning the tiles over, the grey side up. He began his search from a corner moving at an angle of 45° to the walls. Each time he came to a wall, he made a 90° turn. If he stepped on a grey tile, he turned it back so the white side faced up. The search went on until the miser reached an entrance at one of the corners. Then, not having found the gold the tired miser sighed and went back to his home depressed.

Description of Input

The input contains two lines, each of which is an integer. The integer in the first line represents the length of the hall – n , ($2 \leq n$). Integer in the second line represents the width of the hall – m , ($m \leq 1,000,000$).

Description of Output

Output contains a single number which represents the number of grey tiles in the hall after the miser's search.

Sample Case

Input

7
5

Output

11

Problem 8

Complicated Polygon – Meh!

Students taking a 'Water Quality' course have to study the different issues of water quality including pollution of rivers, lakes and oceans. As a class activity, the professor sometimes ask the students to measure the impact of the pollution on various ecosystems in the water such as coral reefs, spawning grounds, and so on.

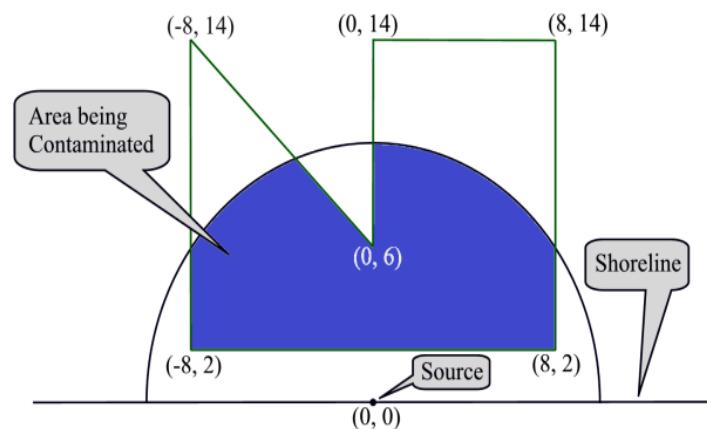


Figure 8.1: Illustration of Sample Input

One day the professor asked the students to monitor an area of a contaminated ecosystem. He gave them the model illustrated in Figure 8.1. The shoreline (the horizontal line in the figure) lies on the x -axis with the source of the pollution located at the origin $(0,0)$. The spread of the pollution into the water is represented by the semicircle, and the polygon represents the ecosystem of concern. The students' task is to determine the area of the ecosystem that is contaminated, represented by the dark blue region in the figure.

Description of Input

Input contains different lines of numbers. The first two lines each contain an integer representing, the number of vertices in the polygon – n and the radius of the pollution field – r , where $3 \leq n \leq 100$ and

$1 \leq r \leq 1000$. These two lines are followed by n lines, each containing two integers x_i, y_i , giving the coordinates of the polygon vertices in counter-clockwise order, where $-1500 \leq x_i \leq 1500$ and $0 \leq y_i \leq 1500$. The polygon does not self-intersect or touch itself. No vertex lies on the circle boundary.

Description of Output

The area of the polygon that falls within the semicircle centered at the origin with radius r . The precision of area can have an absolute error of at most 10^{-3} .

Sample Case

Input

```
6
10
-8 2
8 2
8 14
0 14
0 6
-8 14
```

Output

```
101.576437872
```

Problem 9

Child Prodigy

Alice is a 6-yr old girl who lives in Texas. She is a child prodigy as she can solve tough algebraic equations. One day her dad wanted to test her imagination in detecting the patterns in a block game. Alice was given a set of blocks which have a length twice as long as their height. Her dad asked Alice to build walls out of these blocks. If the wall is two units tall, then there are different numbers of patterns that can be used to build a wall, depending on the desired length of the wall.. Here is an example her dad gave her as shown in Figure. 9.1.

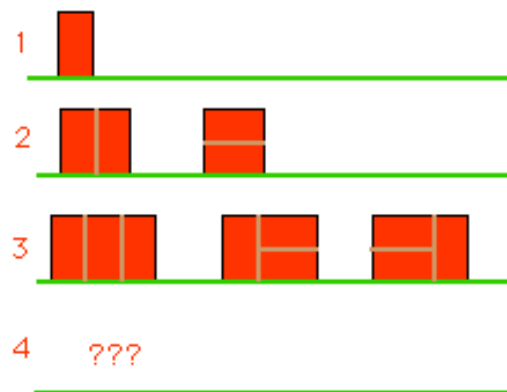


Figure 9.1: Wall patterns made by blocks

- There is only one wall pattern which is 1 unit length – made by putting the block on its end.
- There are 2 patterns for a wall of length 2: two side-ways blocks laid on top of each other and two blocks long-ways up next to each other.
- There are three patterns for walls of length 3.

Alice's dad asked her to tell him how many patterns can be made for walls of different lengths. Since Alice's dad is not a prodigy like his daughter, he wants to write code to solve this problem for him. Help

him determine, using a given number of lengths, how many different possible wall patterns are possible.

Description of Input

Input consists of different sequence of numbers in different lines where each is representing the length of a wall. The maximum value for the wall is length 50. The input terminates with a 0.

Description of Output

For each wall length given in the input, the program should output separate lines corresponding to the possible number of patterns for such a wall.

Sample Case

Input

1
2
3
0

Output

1
2
3

Cartesian Spirals

$$\begin{array}{ccccccc}
 59 & \leftarrow & 53 & \leftarrow & 47 & \leftarrow & 43 & \leftarrow & 41 \\
 \downarrow & & & & & & & & \uparrow \\
 & & 11 & \leftarrow & 7 & \leftarrow & 5 & & 37 \\
 & & \downarrow & & & & \uparrow & & \uparrow \\
 & & 13 & & 2 & \rightarrow & 3 & & 31 \\
 & & \downarrow & & & & & & \uparrow \\
 & & 17 & \rightarrow & 19 & \rightarrow & 23 & \rightarrow & 29
 \end{array}$$

As shown in Figure. 10.1, 2 is located at (0,0). We can see that 3 is located at (1,0), 5 is located at (1,1), 7 is located at (0,1) and 11 is located at (-1,1). Given the coordinates of a prime number in this system, find and display the prime number at that location.

The input data contains multiple pairs of integers in separate lines. Each pair corresponds to the coordinates of a prime number. The termination condition will be a 0.

For each coordinate pair, print that pair, and the prime number that is occurring at that coordinate location in a separate line.

Input

19

2 2
-2 2
0

Output

Location (1,1) is 5.
Location (2,2) is 41.
Location (-2,2) is 59.