Hong Kong Olympiad in Informatics 2014/15 Senior Group

Task Overview

Task	CPU time limit	Max Points
Enumeration	1 second	50
Promotion Period	1 second	100
Apple Garden	1 second	100
Secret Message	1 second	100
Monster Arena	1 second	100

Notice:

Unless otherwise specified, inputs and outputs shall follow the format below:
- One space between a number and another number or character in the same line.
- No space between characters in the same line.
- Each string shall be placed in its own separate line.
- No trailing space(s) in each line.
- No empty lines, except that the input and output should end with the endline character.

C++ programmers should be aware that using C++ streams (cin / cout)
may lead to I/O bottlenecks and substantially slower performance.

For some problems 64-bit integers may be required. In Pascal it is `int64`. In C/C++ it is `long long int`.

Enumeration

Problem

Write a program to read an integer N and output $\frac{N(N+1)}{2}$ integers in the format specified below.

Input

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

Output

The output consists of N lines, the i^{th} line contains i integers, separated by a single space. The last integer of each line is 1. Other integers are greater than the integer on its right by $i - 1$.

Sample test

Input	Output
4	1 2 1 5 3 1 10 7 4 1

Promotion Period

Problem

Snow White is the most beautiful girl in the world. On top of her beauty, there is a well known fact about Snow White - she is an 'appleholic' who always hungers to eat apples.

There is a fruit store near Snow White's castle. Both red apples and green apples are available in the store. There is exactly one seed in each apple. The seed in a red apple is called red seed whereas the seed in a green apple is called green seed.

A promotion campaign is held recently. During the promotion period, customer can trade for one red apple using W red seeds plus X green seeds. They can also trade for one green apple using Y red seeds plus Z green seeds.

Snow White is excited about this news. She has R red apples and G green apples at home and she wants to get more apples by the tradings. Her *happiness* can be quantified. In particular, she will gain P units of happiness after she eats a red apple and Q units after she eats a green apple. Help her find the maximum happiness she can achieve during the promotion period.

Input

The input contains 8 integers in a single line, R, G, W, X, Y, Z, P, Q.

Output

The maximum happiness Snow White can gain.

Sample test

Input	Output
6 4 3 1 1 3 2 6	46

Explanation

Red Apple	Green Apple	Red Seed	Green Seed	Total Happiness	Action
6	4	0	0	0	Initial
0	0	6	4	36	Eat all apples she has
1	0	3	3	36	Trade for a red apple
0	0	4	3	38	Eat a red apple
0	1	3	0	38	Trade for a green apple
0	0	3	1	44	Eat a green apple
1	0	0	0	44	Trade for a red apple
0	0	1	0	46	Eat a red apple

Subtasks

Subtask	Max Points	R, G, W, X, Y, Z	P, Q
1	40	$1 \leq R, G, W, X, Y, Z \leq 10$	$1 \leq P, Q \leq 500$
2	25	$1 \leq R, G, W, X, Y, Z \leq 3000$	$1 \leq P, Q \leq 500$
3	35	$1 \leq R, G, W, X, Y, Z \leq 10^6$	$1 \leq P, Q \leq 500$

Apple Garden

Problem

After the promotion period, the price of apples rises. Snow White decides to grow apple trees in her garden.

The garden is a $N \times N$ grid. There are N^2 cells in the garden. Snow White has planted K apple trees in the garden which are distributed in K different cells. We use (x, y) to denote the cell at the x^{th} row and y^{th} column.

Snow White has bought a machine to collect the apples. The machine can collect all the apples in a $M \times M$ square. The border of the square should be parallel to the border of the garden. Since she loves apples so much, she wants to collect as many apples as possible. As a soldier of Snow White, help her to find the maximum number of apple trees that can be covered by the machine.

Input

The first line contains 3 integers, N, M and K described above. The following K lines each contains 2 integers x_i and y_i ($1 \leq x_i, y_i \leq N$), representing the position of the i^{th} apple tree. The coordinates are sorted in ascending order by x coordinate. No two apple trees were planted in the same cell.

Output

Output one single integer, the maximum number of apple trees the machine can cover.

Sample test

Input	Output
5 3 4 1 1 2 5 4 4 5 5	2

Subtasks

Subtask	Max Points	N, M	K
1	40	$1 \leq N, M \leq 50$	$1 \leq K \leq 30$
2	15	$1 \leq N, M \leq 300$	$1 \leq K \leq 100$
3	15	$1 \leq N, M \leq 2000$	$1 \leq K \leq 200$
4	30	$1 \leq N, M \leq 10^9$	$1 \leq K \leq 2000$

Secret Message

Problem

The evil queen has always been jealous of Snow White's beauty. After the death of Snow White father - the King, the queen has imprisoned Snow White in the most heavily guarded prison in the Kingdom. The queen knows that Snow White has a powerful and intimate friend – Prince Lee Sin in another kingdom. They used to write letter to each other every day. The bonding between Lee Sin and Snow White is so strong that he would suspect that something is wrong if Snow White stops writing to him. So the queen forces Snow White to keep writing letters to Lee Sin and threatens to torture Snow White if she attempts to ask for help in the letters.

Snow White knows this day would happen so she comes up the following encoding scheme to encode her message s:

- List all rotations of s. (See the following example for illustration)
- Sort the rotations in lexicographical order.
- Write down the last character from the sorted rotations to form the code word b.

Example:
Let $s =$ `BCAAD.` ('.' is the character representing the end of message)

1. List all rotations

```
BCAAD.
CAAD.B
AAD.BC
AD.BCA
D.BCAA
.BCAAD
```

2. Sort the rotations (Note that character '`.`' is lexicographically smaller than any capital letter)

```
.BCAAD
AAD.BC
AD.BCA
BCAAD.
CAAD.B
D.BCAA
```

3. Write down the last character from each rotation:
$b =$ `DCA.BA`

It is guaranteed that the input codeword b is recoverable to the original message s. To let Lee Sin receive the call for help, please decode the message from Snow White.

Input

The input consists of one line. It contains the codeword b encoded from original message s. s consists of uppercase letters '`A`' to '`Z`' and ends with a '`.`'.

Output

Output the original string s in a single line.

Sample test

Input	Output
PH.EL	HELP.

Input	Output
BBA.AA	ABAAB.

Subtasks

Subtask	Max Points	N = Length of s	Condition
1	20	$2 \leq N \leq 10$	Other than the '.' at the end, s consists of 'A' and 'B' only.
2	30	$2 \leq N \leq 27$	The characters in s are distinct.
3	25	$2 \leq N \leq 50$	
4	25	$2 \leq N \leq 300000$	

Monster Arena

Problem

Lee Sin has decoded the message from Snow White. He is on his way to Snow White's castle to rescue her. After that, he can marry her and live happily forever. However, the evil queen has already summoned monsters in the arena to prevent Lee Sin's rescue.

Lee Sin is now in the arena. The arena is a square consisting of N rows and N columns. There are $N \times N$ cells in total. The arena is so dark that Lee Sin cannot see where the monsters are. Being a well-prepared man, Lee Sin knows that each monster occupies 1 cell and no two monsters are in the same cell. Moreover, every monster holds a double-sided mirror which is 45 degrees from the edges of the arena. Also, the orientation of all mirrors are the same.

Lee Sin has concluded that either all mirrors are of '`/`' direction or all mirrors are of '`\`' direction. Now he launches a sonic wave from an edge of the arena in the direction perpendicular to the edge. The sonic wave projects in a straight line and is reflected by mirror. Lee Sin has recorded the path that the sonic wave has travelled. Now he wants to determine the positions of monsters being hit. Lee Sin does not want to underestimate the enemies. Therefore he wants to know at least how many monsters are in the arena.

Input

The first line contains N.
N lines follow. Among these N lines, the j^{th} character in the i^{th} line represents the cell in the i^{th} row and j^{th} column of the arena. A cell on the path of the sonic wave is represented by '`#`', and '`.`' otherwise.

Output

If there is no possible solution, output "`Impossible`" (without the quotes).
Otherwise, output N lines following the format in the input. For each cell, output: '`.`' for no monster, '`/`' for a monster holding a mirror in '`/`' direction, and '`\`' for a monster holding a mirror in '`\`' direction
If multiple solution exists, output the one with minimum number of monsters.

Sample test

Input	Output
5 ..... ##... .###. ...#. ...#.	..... .\... .\.\. ....

Input	Output
2 ## ##	Impossible

Subtasks

Subtask	Max Points	N	Condition
1	30	$N = 4$	
2	20	$2 \leq N \leq 1000$	There are no monsters in the outermost row or column.
3	50	$2 \leq N \leq 1000$	

Scoring

For those test cases that the outputs are "`Impossible`", such cases' points will be further multiplied by the points *percentage* you got from the *other* test cases.