Problem A - Arithmetics of Fibonacci Numbers

Input File: pa.in

Time Limit: 3 seconds

Problem Description

The Fibonacci numbers are defined by the recurrence:

Fib(0) = 0

Fib(1) = 1

Fib(N) = Fib(N – 2) + Fib(N – 1)   for all N > 1

Write a program to calculate the arithmetics of two Fibonacci Numbers.

The operational sign will be '+' , '-' or '*'.

Input File Format

In the input file, each line present a test case until the end of file. There will be two integer N1 N2 (0 ≤ N1 and N2 ≤ 2000)and one operational sign OP in each case to present a formula: Fib(N1) OP Fib(N2)

Output Format

For each test case, your program should output the result of the formula, one per line.

Sample input

```
1 3 +
6 8 -
3 5 *
```

Sample output

```
3
-13
10
```

Problem B - Project Matching

Input File: pb.in

Time Limit: 5 seconds

Problem Description

One department of computer science has ten project teams (no. A1-A10), and ten faculty advisers (no. B1-B10). Each project team contains several students. Each adviser must advise a project team. Each project team needs an adviser. The matching results must be done according to the preferences of the advisers and project teams. The preference and matching rules are described as follow.

- Each project team provides a preference order to the advisers. The preference order of project team contains the identifications of ten ad- visers. For example, the preference order of A1 may be (5, 2, 9, 4, 10, 8, 3, 6, 7, 1). The adviser B5 is the first priority. Each adviser also provides a preference order to the project teams. The preference order of adviser contains the identifications of project team. For example, the preference order of B5 may be (7, 2, 1, 6, 10, 8, 3, 5, 4, 9). The project team A7 is the first priority.
- The preference order of project team must be considered to match the guidance relationship between project team and adviser at first. For example, if only project team A8 chooses B7 as its first priority adviser, B7 will be the adviser of A8. If there are more than two project teams (e.g. A8 and A9) that choose the same adviser B7 as their first priority, the matching results are made by the preference order of adviser B7. And if 9 is in front of 8 in the preference order of adviser B7, the adviser of project team A9 must be B7.
- If the project team (e.g. A8) choose the first priority adviser that is already matched by another project team, the project team A8 must choose the second priority adviser, and so on.

Input File Format

The input file will contain multiple test cases. Each test case contains 20 lines. The first 10 lines are the preference orders of 10 project teams. The second 10 lines are the preference orders of the 10 advisers. The cells of the preference order are separated by one space.

Output Format

For each test case, output the ten matching results in which the project team and the adviser separated by commas. The matching results are sorted by the project teams.

Sample input

```
5 2 9 4 10 8 3 6 7 1
5 10 8 4 9 3 2 6 1 7
6 2 9 8 10 3 1 7 5 4
10 2 6 8 7 9 3 1 4 5
6 3 9 2 10 8 4 5 7 1
5 2 7 9 8 4 1 6 3 10
10 2 7 4 5 8 3 6 9 1
7 3 9 8 10 2 1 6 5 4
3 2 6 8 7 9 10 1 4 5
6 2 9 8 10 3 4 5 7 1
1 2 7 6 3 8 10 9 4 5
2 7 3 6 10 9 1 5 4 8
8 5 1 9 10 7 3 2 4 6
7 10 3 6 2 8 9 4 5 1
7 2 1 6 10 8 3 5 4 9
5 3 1 4 10 8 2 7 6 9
7 2 1 5 8 10 3 6 9 4
1 2 6 10 7 8 3 9 4 5
6 4 1 10 3 8 7 5 2 9
2 9 4 5 10 8 1 6 3 7
```

Sample output

```
A1,B9
A2,B5
A3,B1
A4,B10
A5,B6
A6,B4
A7,B2
A8,B7
A9,B3
A10,B8
```

Source

PTC, d199: [11.12] A - Project Matching

URL

http://140.122.185.166/ZeroJudge/ShowProblem?problemid=d199

Problem C - Simple XHTML Table Parser

Input File: pc.in

Time Limit: 3 seconds

David is learning table in XHTML, but keeps forgetting about the closing tags. Therefore, to improve readability, he wants to write a program to help him indent and close all tags properly. In this problem, you will be seeing 5 tags, namely <html>, <body>, <table>, <tr>, and <td>. There will always be opening tags, but closing tags might be missing.

As an example, the following XHTML snippet needs to be aligned and closed properly.

One line with missing closing tag: <html><body></html>

Indented and properly closed:

```
<html>
    <body>
    </body>
</html>
```

For simplicity, <html>, <body>, and <table> tags will only appear once, but <tr> and <td> can appear any number of times. Your job is to write a program that indents (4 spaces per level) the tags properly and adds closing tags if any is missing.

Input File Format

Plain text delimited by any number of spaces with no punctuation.

Single line input, less than 100 character.

Output Format

Plain text delimited by any number of spaces with no punctuation.

Sample input

```
<html><body><table><tr><td></td><td><td></td><tr><td></table></html>
```

Sample output

```
<html>
    <body>
        <table>
            <tr>
                <td></td>
                <td></td>
                <td></td>
            </tr>
            <tr>
                <td></td>
            </tr>
        </table>
    </body>
</html>
```

Problem D - Block Intersection

Input File: pd.in

Time Limit: 3 seconds

Suppose there are N rectangular blocks, all of which have integral coordinates for their vertices and sides that are either parallel or perpendicular to the XY-, YZ-, and XZ-planes. These blocks may or may not intersect one another. Your task is to compute the resulting volume of the intersection of these blocks. Please note that intersection refers to the intersection of all the blocks, not some of the blocks.

Input File Format

The first line of the input file contains an integer, denoting the number of test cases to follow. For each test case, Input consists of lines of information related to the blocks. The first line of each test case contains a single integer N denoting the number of blocks, followed by N lines, each of which contains six integers that are Xmin, Ymin, Zmin, Xmax, Ymax, and Zmax coordinates of a block. The coordinates are separated by blanks and you may assmue that they are all nonnegative integers less than or equal to 150.

Output Format

For each test case, output is simply a single number that is the volume of the intersection.

Sample input

```
2
2
0 0 0 10 10 10
0 0 0 20 20 20
3
0 0 0 10 10 20
0 0 0 10 20 30
0 0 0 5 5 6
```

Sample output

```
1000
150
```

Problem E - The Secret

Input File: pe.in

Time Limit: 1 second

A young guy Mr.Nien wants to confess to a girl he admires, but is afraid of telling her in person. Therefore, he asks his best friend to deliver the message for him, but doesn't want his best friend to know what the message is. As a result, since Nien knows the girl's favorite number, he came up with the idea of encrypting the message by rotating the alphabets right or left some number of positions, and than writes down by using leet language.

As an example, rotate the letters 5 positions to the right would result the following.

Plain: ABCDEFGHIJKLMNOPQRSTUVWXYZ
Cipher: FGHIJKLMNOPQRSTUVWXYZABCDE

Leet is an alternative alphabet for the English language that is used primarily on the Internet, always used by hackers, cracker.

Leet Mapping Table:

<table>
<tr><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td><td>F</td><td>G</td><td>H</td><td>I</td><td>J</td><td>K</td><td>L</td><td>M</td><td>N</td><td>O</td><td>P</td><td>Q</td><td>R</td><td>S</td><td>T</td><td>U</td><td>V</td><td>W</td><td>X</td><td>Y</td><td>Z</td></tr>
<tr><td>4</td><td>8</td><td>(</td><td>|)</td><td>3</td><td>|=</td><td>6</td><td>|-|</td><td>!</td><td>_|</td><td>X</td><td>1</td><td>44</td><td>|\|</td><td>0</td><td>|*</td><td>0_</td><td>|2</td><td>5</td><td>7</td><td>|_|</td><td>\/</td><td>\/\/</td><td>%</td><td>j</td><td>2</td></tr>
</table>

To encrypt the message "I LOVE YOU", Nien simply looks up each letter in the plain and writes down the corresponding leet letter with out space.

Plain: I LOVE YOU
Cipher: N QTAJ DTZ
Leet: |\|0_74_||)72

Write a program to help young guy Mr.Nien easy to complete the love letter.

Technical Specifications

1. The number of need rotate position *n* is no lees than -26 and no more than 26.
2. The number of lines m is no more than 100.
3. The string s are all uppercase character.

Input File Format

The first line of the input file contains an integer, denoting the number of test case to follow. The first line of each test case has the number of need rotate position *n*, next *m* lines was the string *s* need to encrypt, until read a single line number, mean the next test case start.

Output Format

For each test case, output the same lines encrypted string with out space.

Sample input

```
2
-1
HELLO WORLD
5
I LOVE YOU
DO YOU LOVE ME
```

Sample output

```
6|)XX|\|\/|\|0_X(
|\|0_74_||)72
!7|)720_74_||2_|
```

Problem F - Hadamard Transform

Input File: pf.in

Time Limit: 1 second

Problem Description

Hadamard transform is a member of the generalized Fourier Transforms. The Hadamard transform matrix is a 2^m by 2^m matrix that transforms 2^m data vector **x** into 2^m output vector **X** where **x** and **X** are all column vectors. The Hadamard matrix can be obtained recursively as

$$H_m = \frac{1}{\sqrt{2}}\begin{pmatrix} H_{m-1} & H_{m-1} \\ H_{m-1} & -H_{m-1} \end{pmatrix} \text{ and } H_0 = 1$$

And the transformation is done by evaluating the matrix multiplication

$$\mathbf{X} = H_m\mathbf{x}$$

For example, $H_1 = \frac{1}{\sqrt{2}}\begin{pmatrix} 1 & 1 \\ 1 & -1 \end{pmatrix}$ and $H_2 = \frac{1}{2}\begin{pmatrix} 1 & 1 & 1 & 1 \\ 1 & -1 & 1 & -1 \\ 1 & 1 & -1 & -1 \\ 1 & -1 & -1 & 1 \end{pmatrix}$.

An input vector **x** = $[\ 1\ 1\ 1\ 1]^T$ will result **X** = $[2\ 0\ 0\ 0]^T$ where T indicates the matrix transpose.

Technical Specification

The entries in the input vector are all integers ranging from -32768 to 32767.

Input File Format

Only a single line in the input file containing integer values in a row vector format. The number of integer values equal to 2^m.

Output Format

The results of the Hadamard transformation in a format similar to the input file. The value should be rounded to 2 digits after the decimal point.

Sample input

```
2 2 2 2
20 20 20 20 30 30 30 30 -10 -10 -10 -10 -20 -20 -20 -20
```

Sample output

```
4 0 0 0
20 0 0 0 0 0 0 0 80 0 0 0 -20 0 0 0
```

Problem G - Connect the Dots

Input File: pg.in

Time Limit: 5 seconds

In this problem, you are required to write a program to simulate the "Connect the Dot" game in a two dimensional N * N grid. Each box, or point of the grid can hold an integer. In the input file, you'll be given a list of points with their coordinates, and each of the points in the list will be labeled with an index. After the list of points, there will be a series of commands, each of the commands will instruct you to either make or break the connection between two points, given their labeled index. There will only be one test case within an input file.

- When making the connection between two points, fill in the smaller of the two index into the points along the line.
- When breaking the connection between two points, restore the content of the points along the line to the content of the points before the specified connection is made.
- If multiple connections pass through a single point, then the content of the point shall be the content set by the last connection made.
- If either of the index given in a command refers to non-existent points, then that command shall be ignored.
- If the break connection command is issued on a pair of points that wasn't connected, then the connection break command is ignore.
- You can assume that when a make connection command is issued, the pair of points is not already connected.

The definition of the points alone the line is given below:
Let point 1 be (Xnum1, Ynum1), and point 2 be (Xnum2, Ynum2).
If | Ynum2 –Ynum1 | ≧ | Xnum2 –Xnum1 |, then the "points along the line" is given as (X,Y), where Y is all integers between Ynum1 and Ynum2 (inclusive), and X is

$$X = \frac{\text{Xnum2 -Xnum1}}{\text{Ynum2 -Ynum1}} * (\text{ Y} - \text{Ynum1 }) + \text{Xnum1}$$

Otherwise, if | Ynum2 –Ynum1 | < | Xnum2 –Xnum1 |, then the "points along the line" is given as (X,Y), where X is all integers between Xnum1 and Xnum2 (inclusive), and Y is

$$Y = \frac{\text{Ynum2 -Ynum1}}{\text{Xnum2 -Xnum1}} * (X - \text{Xnum1}) + \text{Ynum1}$$

When using the above formulas, the final result should be round off to the nearest integer.

Input File Format

There will be an integer N on the first line of input file, denoting that the size of the grid is N * N, N less than 200; Starting from the second line, each line will have three integers separated by white space, they are X, Y and num, for which 0 <= X < N, 0 <= Y < N, and 0 < num < 2^{32}, and it is not guaranteed that num is sequential or will occupy continuous series of integers. After that, every line until the end of the fie will contain a string and two integers, they are mode, num1, and num2 respectively, also separated by white space. If the string mode is "al", then it is a command to make a connection between points labeled with index num1 and num2. Otherwise, if the mode is "dl" then it is a command to break the connection between points labeled with index num1 and num2.

Output Format

Print out the final two dimensional N * N grid's content, if the content of the point is empty, in the other words, no connection passed through it, then output 0 for that point. The content of each of the points are separated by white space.

Sample Input

```
9
0 0 2
0 8 5
5 6 7
4 0 13
0 4 20
3 4 8
al 5 8
al 2 7
dl 5 8
al 20 13
```

Sample Output

```
2 0 0 0 13 0 0 0 0
0 2 0 13 0 0 0 0 0
0 0 13 0 0 0 0 0 0
0 13 0 2 0 0 0 0 0
20 0 0 2 0 0 0 0 0
0 0 0 0 2 0 0 0 0
0 0 0 0 0 7 0 0 0
0 0 0 0 0 0 0 0 0
5 0 0 0 0 0 0 0 0
```

Problem H - Trajectory of a projectile

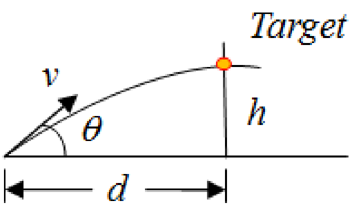
Input File: ph.in

Time Limit: 1 second

Problem Description

In this problem, you are asked to calculate the launch angle of a projectile in order to hit the distant target at a given height, as shown in the figure. The input parameters are the initial speed of the object *v*, the horizontal distance *d* between the emitting site and the target, and the vertical height *h* of the target. The output is the emitting angle θ in degree of the projectile rounded to 2 digits after the decimal point. The output will be -1 if it is not possible. If there are two solutions satisfied, the one which gives the projectile in ascending movement shall be chosen. Only the gravity g = 9.8 m/s^2 is considered as the influencing factor. That is, we will ignore the resistance of the air as well as the wind speed and wind direction.

Some of the equations you may need are listed below:



Initial speed: v

Horizontal speed: $v_H = v\cos\theta$

Vertical speed: $v_V = v\sin\theta - gt$

Horizontal distance traveled: $x = v\cos\theta t$

Height variation: $y = v\sin\theta t - \frac{1}{2}gt^2$

Time traveled distance *d* : $t = d / v\cos\theta$

Height at time *t* : $h = v\sin\theta * d / v\cos\theta - \frac{1}{2}g(d / v\cos\theta)^2 = d * v\tan\theta - \frac{1}{2}g(d / v\cos\theta)^2$

Example: *v* = 210 m/s; *d* = 4000m; *h* = 400m.

The solution of launch angle could be either *θ* = 42.72 degree (ascending) or 52.99 degree (descending). So the answer is 42.72 degree.

Technical Specification

The range of parameters is: $200 \le v \le 300$, $3000 \le d \le 5000$, $50 \le h \le 500$

Input File Format

Only one line is in the input file. The values are specified as *v*, *d*, *h* with one blank after the comma.

Output Format

The launch angle in degree rounded to 2 digits after the decimal point. Output '-1' if the speed is not able to achieve the goal.

Sample input

```
200, 4000, 400
210, 4000, 400
250, 3000, 100
```

Sample output

```
-1
42.72
16.07
```

Problem I - Centering Data in Table

Input File: pi.in

Time Limit: 3 seconds

Problem Description

Your program should read in n*m strings, and print the strings in their input order in the following table format:

1. All cells in the same column have the same width.
2. Each cell is at least 2 spaces longer than the string displayed in it.
3. Each string is positioned at the center of a cell. To be precise, let L denote the number of spaces to the left of the string and R the number of spaces to the right of the string. Either R=L or R= L+1.
4. The numbers of spaces in cells are minimal.

Technical Specification

Each input string is printable and has no space in it. The characters in each string have the same width.

Input File Format

The input file has n lines, and each line has m strings separated by one space.

For each line less than 100 character

Output Format

The output format is as described in Problem Description. But to make the output more readable, print each space as a "-".

Sample input

```
13579 456 543 246802
24 7654 987 456
356 5 45678 25
```

Sample output

```
-13579--456----543---246802-
--24----7654---987----456---
--356----5----45678----25---
```