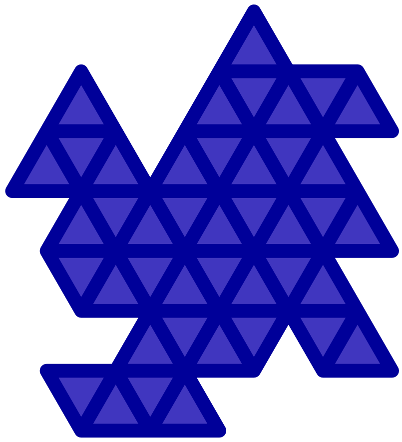
C Colby's Costly Collectibles



At the Colby's Costly Collectibles workshop, special jewels are manufactured. In his production process Colby first creates a large grid of stones, each of which has the shape of an equilateral triangle. From this grid he cuts out all kinds of shapes which he sells as pieces of jewellery. Customers can choose their preferred shape according to the following basic rules:

1. Cuts can only be made along the edges of the triangles.
2. The jewel must consist of one piece. A connection at a vertex is too weak, so the triangles must be connected by their edges.
3. The jewel cannot contain any holes.

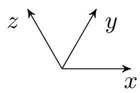
To illustrate the production process, a typical jewel is depicted in the figure on the right. This corresponds with the third test case in the samples below.

Since the customer has to pay per triangle, Colby has asked you to help him calculate the number of triangles used. You are given a description of the jewel's outer boundary. Note that it follows from rules 2 and 3 that the boundary will never intersect or touch itself.

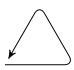
Input

The input starts with a line containing an integer T, the number of test cases. Then for each test case:

- One line with a single integer C, the number of cuts made. This number satisfies $3 \leq C \leq 100$.
- Then C lines follow, describing the boundary of the jewel in counterclockwise orientation. Each line starts with a single letter x, y or z, denoting the direction in which to move, followed by an integer denoting the number of steps. The directions correspond with the axes depicted below:

  To further illustrate this, the first test case below describes a single triangle, starting from the lower left corner:

  (First take one step in the x direction, then one step in the z direction and finally one step in the negative y direction.)

The boundary will never touch itself. It will always end up where it started and the total length of the boundary will not exceed 1000. The path starts at a vertex and the endpoint of every segment will again be a vertex. (In other words, no two consecutive edges in the input will be in the same direction, not even the first and the last edge.)

Output

For each test case, output one line with a single integer N, the number of triangles.

Sample input and output

Input	Output
3 3 x 1 z 1 y -1 3 y 333 x -333 z -333 23 y -3 z 2 y -2 x 1 y -1 z -1 x 1 y -1 x -1 z -1 x 2 z 1 x 1 y 1 z -1 x 1 z 2 x 1 z 2 x 1 z 1 x -1 z 1	1 110889 42

E Icelandic Motorclubs

The country of Iceland has a huge number of beautiful sights, including waterfalls, lava fields, cliffs, geysirs, valleys, volcanoes, glaciers, whales, seals, sheep and much more. Recently, the country has attracted the attention of motor clubs. Expelled from their home countries as a result of revealing reality TV programs, they now seek to bike elsewhere. Members of motor clubs have a lot of money (how else would they be able to pay for all those fancy motor bikes), and thus also own private planes that can drop them with a parachute together with their motor cycle anywhere they want.

The country of Iceland has many rough roads that are not suitable for motor driving, but luckily Iceland has one accessible paved ring road (Road 1) that makes a circle, passing by all the beautiful sights an adventurous motor driver may be interested in. However, Iceland is sparsely populated, and there are not so many gas stations. In fact, in rough winter times, there are barely enough gas stations supplied with gas to make a full round trip with one motor cycle. In the winter, only the inner clockwise lane (Iceland drives right) is free of snow.

Nevertheless, a biker is brave and will try to make a round trip. Luckily, bikers know how much gas is at each gas station and know the distance between each subsequent pair of gas stations on the ring road of Iceland. Also, bikers do not have to worry about the size of the gas tank on the motor bike: it is assumed to be of infinite size. Also, filled gas tanks collapse under air pressure, so the biker jumps out of the plane with an empty tank.

Given the distance between each subsequent pair of gas stations and the amount of gas available at each gas station, at which gas station should the biker start in order to complete a full clockwise circle without running out of gas? Assume that motor bikes are not the most eco-friendly vehicles: they use one liter of gas to drive one mile.

Input

The input starts with a line containing an integer T, the number of test cases. Then for each test case:

- One line containing an integer $3 \leq N \leq 1{,}000\,000$ denoting the number of gas stations on the circular road (assume stations are numbered from 1 to N).
- N lines, each describing a gas station using two space-separated integers G and D (with $0 \leq G \leq 512$ and $1 \leq D \leq 512$), representing the amount of gas available at this gas station and the distance to the next gas station in miles. Because it is a circular road, the final gas station N lists the distance to gas station 1.

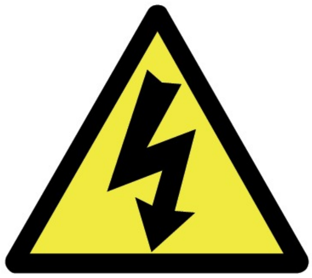
Output

For each test case, output one line containing an integer representing the number of a gas station where the biker could start his round trip. If there are multiple solutions, output one. If the round trip cannot be made, output one line containing the string `IMPOSSIBLE` instead.

Sample input and output

Input	Output
2 5 1 2 3 2 3 4 3 1 0 1 3 3 4 2 3 4 3	2 IMPOSSIBLE

F Manhattan Power Failure



There has been a huge storm ravaging through Manhattan destroying many power-lines and leaving entire blocks without power. The first damage assessment came up with a report showing which blocks are still connected by power lines and which are not. When a block is connected to another block with power lines, this means that if one block has power, then the other will also have power. Only blocks that are adjacent (either horizontally, or vertically) may be connected by a power line. Also, there is a quickly made list with all blocks that have power generators, or that are connected to external power sources.

Your task is to quickly identify where to put up emergency power lines, so that all block of this grid-like city have power again.

Input

The input starts with a line containing an integer T, the number of test cases. Then for each test case:

- One line with four integers, n, m, p, c, where n, m ($1 \leq n, m \leq 100$) are the number of blocks that the city is wide respectively long (the city has n x m blocks), p ($1 \leq p \leq n \cdot m$) is the number of power generators, and c ($1 \leq c \leq 2n \cdot m$, or in fact: $1 \leq c \leq 2n \cdot m - n - m$) is the number of intact power lines between adjacent city blocks.
- p lines, each with two integers x ($0 \leq x < n$), y ($0 \leq y < m$) indicating that the block with coordinates (x, y) in the grid has its own power source or is connected to an external power source.
- c lines, each with two integers x ($0 \leq x < n$), y ($0 \leq y < m$), and a character d ($d =$ 'R' or $d =$ 'U') indicating that there is an intact power line either between block (x, y) and block $(x+1, y)$ if $d =$ 'R', or between block (x, y) and block $(x, y+1)$ if $d =$ 'U'. Of course, if $x = n-1$, then d cannot be 'R'. Likewise, if $y = m-1$, then d cannot be 'U'.

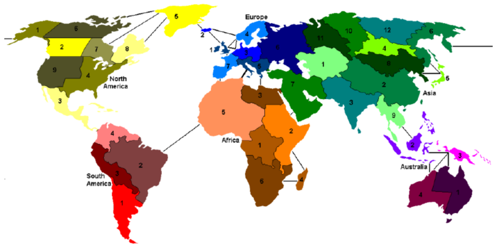
Output

Per test case, output one line with one integer indicating the number of emergency power lines needed to connect all blocks to a power source.

Sample input and output

Input	Output
2	2
2 3 2 3	1
0 2	
1 1	
0 0 U	
0 2 R	
1 1 U	
2 4 2 6	
0 3	
1 0	
0 0 U	
0 1 U	
0 1 R	
0 2 R	
0 3 R	
1 1 U	

H Risk



Good old friends Vladimir and Barack like to play games together. One of their favourites is the strategy board game Risk, where players occupy certain regions of the world, and are to conquer all regions of specific continents. Once in a while, Vladimir challenges the little boys in the neighbourhood for a game. This time, he asked Mark, who immediately said yes, excited that he was invited to play with one of the big boys.

Only later, Mark realized that Risk is a serious game and that Vladimir is a much more experienced player than he is. In order to have at least a little chance, Mark ask you for your advice on a specific aspect of the game. In particular, can you tell him what the probability is that Mark, occupying a certain region with M armies, wins the battle if he decides to attack an adjacent region occupied by Vladimir with N armies?

Rules for a battle

We consider the standard rules of Risk, with one exception: the dice used do not necessarily have six sides. The dice may have any number of sides $D \geq 1$, all sides having different values and equal probability.

During a battle, the two players take turns in rolling the dice, until one of them has won. Suppose that the attacking player has A armies left in the region from which he is attacking, and that the defender has B armies in his region. Then first, the attacker rolls $\min\{3, A-1\}$ dice. That is, in principle, he uses three dice. However, if $A < 4$, he uses $A - 1$ dice, one die for each army he has minus 1, because one army must remain in the region and is not involved in the attack. Now, if $B = 1$, the defender rolls one die. If $B \geq 2$, the defender chooses to roll one or two dice, so as to optimize his probability to win the battle.

Each player's highest die is compared, as is their second-highest die (if both players roll more than one). In each comparison, the highest number wins. The defender wins in the event of a tie. With each dice comparison, the loser removes one army from his region from the game board. Any extra dice are disregarded and do not affect the results.

For example, suppose that the attackers rolls three dice, yielding 4, 2 and 1, and that the defender rolls two dice, yielding 3 and 2. Then the first comparison (between 4 and 3) is won by the attacker, the second comparison (between 2 and 2) is won by the defender. As a result, both players lose one army. If, as another example, the attacker has two dice showing value 6, then it may be wise for the defender to roll only one die, so he loses at most one army.

The battle is over, when either the attacker has only one army left (the defender has won) or the defender has no more army left (the attacker has won).

Input

The input starts with a line containing an integer T, the number of test cases. Then for each test case:

- One line containing an integer D satisfying $1 \leq D \leq 20$: the number of sides of the dice in the game.
- One line containing two space-separated integers M and N satisfying $2 \leq M \leq 100$ and $1 \leq N \leq 100$: the number of armies at Mark's region, and the number of armies at Vladimir's region, respectively.

Output

For each test case, output one line with a single real value: the probability that Mark wins the battle. An absolute precision error of 0.0001 is allowed. Scientific notation is also allowed.

Sample input and output

Input	Output
3	0.363205
6	0.322393
10 10	0.734746
2	
7 3	
15	
85 98	

I Rummikub

Rummikub is a simple game, often played by elderly people versus their grandchildren. The tile set consists of four suits, represented by the colors blue, green, red and yellow. Each suit consists of $N > 0$ different tiles, numbered from 1 to N. The number of a tile represents the *value* of that tile. There are two tiles of each (value, color) combination.

At the start of the game, the referee deals each player a hand of tiles. These are only visible to them. All other tiles that are not dealt to any player are placed face down on the table, and form the pool. The players take turns in playing tiles. Any tile that is played must be an element of either a group or a run. A *group* is defined as a set of at least three tiles of the same value but a different suit. A *run* is defined as a set of at least three tiles of the same suit but with consecutive values. If a player cannot play any tiles, the player must take a tile from the pool.

The elderly people like progress a lot. They love to play lots of tiles each turn, and they hate it when they have to pick a tile from the pool, as this retains progress. Sometimes, the elderly people accidentally take a tile from the pool, because they overlook a run or group in their hand. You have been asked to solve this problem for them. Given a hand of tiles, write a program that determines whether they can create a new run or group.

Input

The input starts with a line containing an integer T, the number of test cases. Then for each test case:

- One line with an integer M, satisfying $1 \leq M \leq 800$: the number of tiles the player has in his hand.
- One line with M space-separated strings, representing the tiles in the hand. Each tile string consists of an integer V satisfying $1 \leq V \leq 100$ (the value), and a character which is either `b`, `g`, `r` or `y` (representing the suit).

Output

For each test case, output a single line containing the string `YES` if the player can form a run or a group; `NO` otherwise.

Sample input and output

Input	Output
2	YES
3	NO
1r 2r 3r	
4	
1r 1y 2g 3g	