Problem A
Cake Game
Max no. of test cases: 10
Time limit: 1 second

On a birthday cake, four red candles and four green candles are placed. The boys and the girls in the party come up with a game to play. The girls play first and draw a line by connecting two red candles of their choice. The boys play next and must draw two non-intersecting lines, each connecting two green candles. Each candle can only be used once. If the boys can successfully draw two non-intersecting lines without crossing the line drawn by the girls, the boys win the game, if not the girls win.

In the example given in Fig. 1, the circles are the red candles and the triangles are the green candles. In this example, no matter how the girls connect the red candles, the boys can always find a way to draw two lines to connect the green candles to win the game.

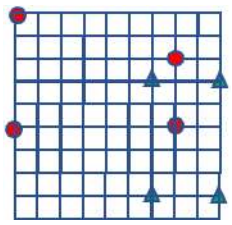

Figure 1: Boys can always win the game regardless of how girls play the game.

In Fig. 2, if the girls draw the dash line first, then the boys will have no mean to draw two lines without crossing the dash line. Therefore, girls win this game.

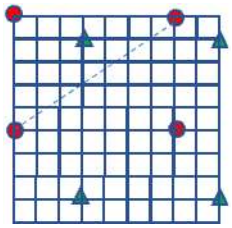

Figure 2: Boys cannot always win the game.

Given the positions of the 4 red candles and 4 green candles, please determine whether these is a way for girls to draw the first line so that boys cannot win the game.

Input File Format

The first line of the input contains one integer denoting the number of test cases to follow. For each test case, there are 2 lines. First line contains 8 integers, which are

x, y coordinates of the 4 red candles. The second line contains 8 integers, which are x, y coordinates of the 4 green candles. The coordinates are integers between 0 and 9, $0 \leq x, y \leq 9$. Obviously, no two candles will be placed at the same position.

Output Format

Output "G" if there is a way for girls to draw the first line to win the game. If not, output "B", if boys can always win the game no matter how the girls draw the first line.

Sample Input

```
3
0 0 7 0 0 5 7 5
6 3 9 3 6 8 9 8
0 0 7 0 0 5 7 5
3 1 9 1 3 8 9 8
0 0 0 2 2 0 2 2
4 4 4 6 6 4 6 6
```

Output for the Sample Input

```
B
G
B
```

Problem B
Subarray Sums
Max no. of test cases: 10
Time limit: 2 seconds

Given an array X that stores a set of positive integers, please write a program to find the maximum value among the remainders obtained by dividing the sums of the subarrays in X by a given divisor. For example, if we have the array X = [2, 1, 3, 4], then there are 10 subarrays, namely [2], [2, 1], [2, 1, 3], [2, 1, 3, 4], [1], [1, 3], [1, 3, 4], [3], [3, 4], [4]. And the subarray sums are: $2, 2+1 = 3, 2+1+3 = 6, 2+1+3+4 = 10, 1, 1+3 = 4, 1+3+4 = 8, 3, 3+4 = 7$, and 4. If the divisor is set to 5, the remainders are: 2, 3, 1, 0, 1, 4, 3, 3, 2, and 4, respectively. The maximum remainder value is 4 which would be from subarrays [1, 3] and [4].

Input File Format

The first line of input contains an integer n, indicating the number of test cases. For each test case, the first line contains an integer s, $1 \leq s \leq 5000$, which is the size of the array X. The second line contains s positive integers (≤ 99999), indicating the s elements in the array X. The last line contains an integer d, representing the divisor.

Output Format

For each test case, output an integer on a single line, indicating the number of subarrays with the maximum remainder value.

Sample Input

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

Output for the Sample Input

```
2
```

Problem C
Ladder Game
Max no. of test cases: 30
Time limit: 2 seconds

A ladder diagram consists of n vertical lines with some random horizontal line segments connecting two adjacent vertical lines at different positions along the vertical lines. There are distinct lottery numbers at the bottom of the vertical lines, corresponding to the prizes won. The game is played by choosing to start at the top of a vertical line and move down the lines until a horizontal line segment is reached. In which case, the player followed that horizontal line segment to the adjacent vertical line and continue to move downward. The process is continued until all players have reached the bottom of the vertical lines and have received their prizes. Note that all players choose and start at the top of distinct vertical line and that all players move at the same pace.

For example, in Fig. 1 the sample input shows 4 vertical lines. There is a horizontal line segment connecting vertical lines 1 and 2 at position 1 along the vertical lines.. There is also a horizontal line segment connecting vertical lines 3 and 4 at position 3 along the vertical lines. If four players play the game, each starting at different vertical line, players choosing vertical lines 1 and 2 will cross each other at the first horizontal line segment, while players choosing vertical lines 3 and 4 will cross each other at the second horizontal line segment.

```
|_| | |
| | | |
| | |_|
| | | |
```

Figure 1: A valid ladder game with 4 vertical lines and 2 horizontal line segments.

For this ladder game, It is guaranteed that horizontal line segments will not appear in the last line. Furthermore, there will not be consecutive horizontal line segments that joins 3 or more vertical lines at the same horizontal position. The horizontal line segments shown in Fig. 2 are not allowed.

```
| | | |
| | | |
| |_|_|
|_| | |
```

Figure 2: Invalid ladder game.

During the Lunar New Year, Jack and his family are playing the ladder game to draw red envelops. However, to ensure fairness, Jack want to make sure no two player cross path (meet up somewhere) during the game. Given a ladder game diagram, please help Jack determine what's the maximum number of people that can play the game without possibly crossing each other.

Input File Format

The first of input contains a single integer denoting the number test cases to follow. For each test case, the first line has two integers, n and m, where $1 \leq n, m \leq 1000$, denoting n vertical lines of length m. The next m lines define the ladder game to be played. For the next m lines, each line contains $2 \times n - 1$ characters, the characters are "|" (at the odd positions, denoting vertical lines) and "_" or space (at the even positions, denoting whether there is a horizontal line segment connecting two adjacent vertical lines). All input ladder games are guaranteed to be valid games.

Output Format

For each test case, output a single integer denoting the maximum number of players can play the given ladder game without having the possibility to cross path.

Sample Input

```
1
4 4
|_| | |
| | | |
| | |_|
| | | |
```

Output for the Sample Input

```
2
```

Problem D
Little Red Riding Hood
Max no. of test cases: 20
Time limit: 2 seconds

Little Red Riding Hood is a beloved girl that everyone adores. One day, her grandmother fell ill, and she hoped to visit her grandmother as quickly as possible.

In Little Red Riding Hood's world, there are a total of a hours during the day and b hours at night. She can only travel through the villages during the day. If she's not in any village by nightfall, she will be eaten by the big bad wolf.

Little Red Riding Hood lives in Village 1, and her grandmother lives in Village n. The villages are connected by a network of roads, each requiring a certain amount of time to travel.

Since Little Red Riding Hood can only travel one kilometer per hour, starting from her village (Village 1), how long does it take her at the shortest to reach her grandmother's village without being endangered by the big bad wolf?

Input File Format

The first line of input contains an integer denoting the number of test cases to follow. For each test case, the first line contains four integers, n, m, a, and b, denoting that there are n villages, m roads connecting villages, a hours in the day and b hours in the night. The next m lines, each contains 3 integers, u, v, and w, denoting that there is a road connecting villages u and v with a distance of w.

- $2 \leq n \leq 2 \cdot 10^5$
- $0 \leq m \leq 2 \cdot 10^5$
- $1 \leq a, b, w \leq 10^9$
- $1 \leq u, v \leq n$, $u \neq v$

Output Format

For each test case, output a single integer on a line, denoting the shortest among of time needed for Little Red Riding Hood to reach grandma's village safely. If it is not possible to do so, output -1.

Sample Input

```
2
4 4 5 3
1 2 2
2 3 3
1 3 3
3 4 5
6 4 5 3
1 3 2
3 4 3
4 5 2
5 6 1
```

Output for the Sample Input

```
13
11
```

Problem E
Twinkle, Twinkle, Little Triangle
Max no. of test cases: 30
Time limit: 1 second

Zeus plans to create a new star cluster. He establishes a two-dimensional coordinate system on a plane. The origin (0,0), has a star numbered as no.1. He extends three stars outward at intervals of 120°, positioned at $(L, 0), (-\frac{1}{2}L, \frac{\sqrt{3}}{2}L)$, and $(-\frac{1}{2}L, -\frac{\sqrt{3}}{2}L)$, and are labeled as stars no.2, no. 3, and no. 4, respectively.

Furthermore, originating from each of the above three stars, no.2, no.3, and no.4, Zeus projects three additional stars outward with half of the previous length, namely $\frac{L}{2}$, and at intervals of 120°. These new stars are then rotated counterclockwise by 30° around the corresponding central star to determine their final positions. Following the same procedure, more new stars are generated iteratively. Note that from star i, three stars, namely stars no.$3i-1$, $3i$, and $3i+1$ are created. Consequently, stars originate from no.3 are named as no.8, no.9, and no.10; stars originate from no.4 are identified as no.11, no.12, and no.13; and stars originate from no. 5 are identified as no. 14, no. 15, and no. 16. An illustration of the above explanations can be found in Figure 1.

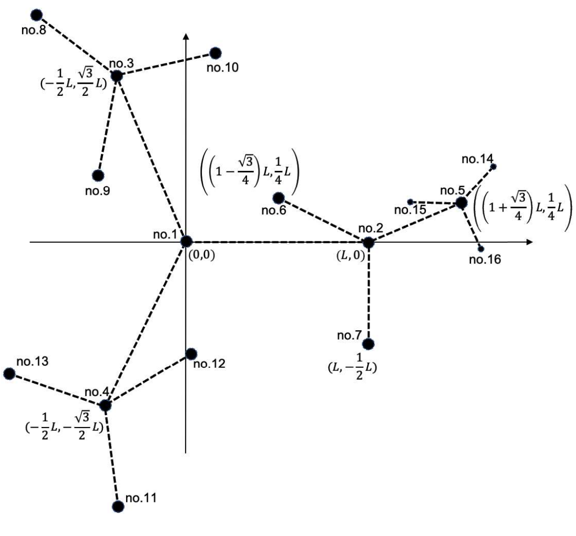

Figure 1: An illustration of forming the star cluster. Note placement of stars (black dots) in this figure may not be true to scale.

As shown in Fig. 1, stars no.5, no.6 and no.7 originate from star no.2, and are $\frac{L}{2}$ from star no.2. These 3 stars extend from star no.2 along the axis defined by star 2 and its central star (namely star 1), resulting in the points $(\frac{3}{2}L, 0), (\frac{3}{4}L, \frac{\sqrt{3}}{4}L)$, and $(\frac{3}{4}L, -\frac{\sqrt{3}}{4}L)$. After a 30° counterclockwise rotation around star no.2, their positions become: $((1 + \frac{\sqrt{3}}{4})L, \frac{1}{4}L), ((1 - \frac{\sqrt{3}}{4})L, \frac{1}{4}L)$, and $(L, -\frac{1}{2}L)$. These three new stars are subsequently designated as no.5, no.6, and no.7 in a counterclockwise sequence. Furthermore, stars no.14, no.15, and no.16, all originate from star no.5 along the axis defined by star 5 and its central star (namely star no.2). Their distance to star no.5 are all $\frac{L}{2 \times 2}$.

Given the star cluster formed from above procedure, please determine the type of triangles that is formed from any three stars.

Input File Format

The first line has an integer n ($n \leq 30$), denoting the number of test cases. The second line contains an integer L. The next n lines each has 3 integers, which are stars' numbers selected to form a triangle. There are at most 100 stars.

Output Format

For each test case, output whether the triangle formed is "Equilateral" or "Isosceles". If it is neither, then output whether the triangle is "Right", "Acute" or "Obtuse". If the three points cannot form a triangle, then output "Null" on a single line. For this task, length or degree accuracy is set to 10^{-5}.

Type	Definition
Equilateral	all three sides have the same length
Isosceles	only two sides have the same length
Right	one angle is right angle (equals to 90°)
Acute	angles are all acute (less than 90°)
Obtuse	one angle is obtuse (greater than 90°)

Sample Input

```
3
100
2 3 4
3 4 1
7 3 2
```

Output for the Sample Input

```
Equilateral
Isosceles
Obtuse
```

Problem F
Drones
Max no. of test cases: 30
Time limit: 2 seconds

StarLine company established N outpost stations along a long road on the moon. A drone patrols all N outpost stations every day, and the cost to operate the drone increases with the total distance. In fact, if the distance between the two farthest stations is d, then the cost is $10 + d^2$ (i.e. d squared, plus a fixed cost of 10). To cut the cost of drone operation, StarLine company decides to add more drones to patrol the outpost stations. For example, if 3 stations are located at position 0, 1, and 10, the cost to patrol with just one drone is $10 + 10^2$. With two drones (one drone patrols positions 0, 1, and one drone patrols position 10), the total cost will be reduced to $(10 + 1^2) + (10 + 0^2) = 21$. However the cost of patrol with 3 drones will be at least 30 which is higher than the cost with two drones.

Given the positions of N outpost stations, please determine the minimum cost to patrol all stations.

Input File Format

The first line of the input contains one integer denoting the number of test cases to follow. For each test case, the first line of the input contains one integer N, $1 \leq N \leq 1000$, which is the number of the outpost stations. The next line contains N integers in increasing order, which represent the positions of the N outpost stations. The positions are between 0 and 10,000, inclusive.

Output Format

For each test case, output an integer on a single line, which is the optimal (minimum) cost for patrolling all stations.

Sample Input

```
1
4
0 2 8 10
```

Output for the Sample Input

28