Problem C - Monumento à Ciência

If this is your first time competing, check our instruction page for detailed information on the format of this problem.

The National Science Museum decided to create a monument to celebrate the portuguese scientific advances. The monument will be made with different bricks that will be placed in different ways, following very specific rules. Each brick will be painted with one of three colors: red (*vermelho*), blue (*azul*) or white (*branco*).

Part I

The first monument will be built with $\boldsymbol{N}$ bricks placed side by side, forming a line. The monument has to obey to the follwing rule: any three consecutive bricks cannot have all the same color and cannot have all different colors.

The artist who is in charge of painting the bricks has already painted some bricks, but now needs to know in how many ways he can paint the remaining bricks while obeying the monument rule.

Given $\boldsymbol{T}$ color sequences, representing partially painted monuments, with the i-th sequence having $\boldsymbol{N_i}$ bricks, determine in how many ways is it possible to paint the brick such that in the correspondent monument any three consecutive bricks do have all the same color and do not have all different colors. Given that the number of ways to paint the bricks can be really large, if the answer is bigger than 10^{10} you should print the word "`grande`" (meaning *big*) instead of an integer.

Example

Suppose you have $\boldsymbol{N} = 5$ and the following partially painted bricks:

Then, there is only one way of painting the middle brick, while respecting the rule, which is painting it in blue. Note that if you paint it in red, then the first three bricks would have the same color. If you paint it in white, then the last three bricks would all have different colors.

Constraints

The following limits are guaranteed for all test cases of this part that will be given to the program:

$1 \leq \boldsymbol{T} \leq 10$	Number of monuments
$1 \leq \boldsymbol{N_i} \leq 100$	Number of bricks per monument

The test cases of this part of the problem are organized into two groups:

Subtask	Points	Additional Constraints
1	15	$\boldsymbol{N} \leq 8$
2	35	No further restrictions

Part II

The second monument will be built in a triangle shape with $\boldsymbol{N}$ in its bottom base, such that, excluding the base bricks, each brick is directly above 2 bricks. The monument has to obey the following rule: if a brick has underneath two bricks of the same color, then it should have that color, but if instead it has two bricks of different colors, it should have the other third color.

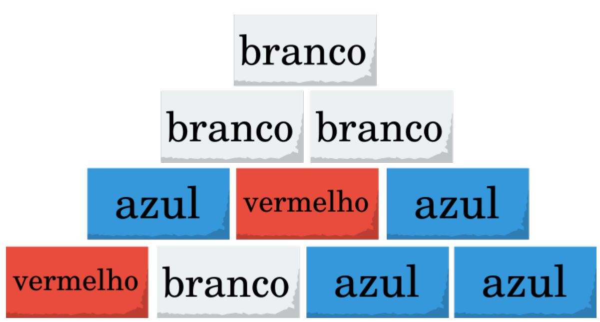
The artist who is in charge of painting the bricks has already painted the base bricks of the triangle, but now needs to know what will be the color of the brick in the top of the monument.

Given $\boldsymbol{T}$ color sequences, representing the colors of the base of a brick triangle, with the i-th sequence having $\boldsymbol{N_i}$ bricks, determine the color of the top brick knowing that in the monument, a brick above two bricks of the same color should have that same color, but if it is above two bricks of different colors it should have the other third color.

Example

Suppose that $\boldsymbol{N} = 4$ and that we have the following painted bricks on the base:

Then, following the rules, the top brick should be white. The following image illustrates the resulting monument.



Constraints

The following limits are guaranteed for all test cases of this part that will be given to the program:

$1 \leq \boldsymbol{T} \leq 10$	Number of monuments
$1 \leq \boldsymbol{N_i} \leq 10^5$	Number of bricks per monument

The test cases of this part of the problem are organized into two groups:

Subtask	Points	Additional Constraints
3	15	$\boldsymbol{N} \leq 100$
4	35	No further restrictions

Summary of Subtasks

The test cases for the problem are organized into four groups with different additional restrictions:

Subtask	Points	Part	Additional Constraints
1	15	Part I	$\boldsymbol{N} \leq 8$
2	35	Part I	No further restrictions
3	15	Part II	$\boldsymbol{N} \leq 100$
4	35	Part II	No further restrictions

Input Format

The first line contains an integer $\boldsymbol{P}$, which represents the part that the test case represents. If it is 1, then the test case refers to Part I, if it is 2 then it refers to Part II.

This is followed by a line with an integer $\boldsymbol{T}$, representing the number of monuments to consider.

$\boldsymbol{T}$ sets of lines come next, each one in the following format:

A line with an integer $\boldsymbol{N}$, the number of bricks in the monument (Part I) or in the base of the triangle of the monument (Part II).

A line with $\boldsymbol{N}$ chars, representing the brick colors: '`A`' azul (*blue*), '`B`' branco (*white*) or '`V`' vermelho (red). On Part I we can also have a '`?`', representing an unpainted brick.

Output Format

Part I

The output should contain $\boldsymbol{T}$ lines, each one containing an integer: the number of ways to paint the unpainted bricks.

Notice: Given that the number of ways to paint the bricks can be really large, if the answer is bigger than 10^{10} you should print the word "`grande`" (meaning *big*) instead of an integer.

Part II

The output should contain $\boldsymbol{T}$ lines, each one containing a character representing the color of the top brick, which should be 'A' azul (*blue*), 'B' branco (*white*) or 'V' vermelho (red).

Example 1 Input

```
1
1
5
VV?AV
```

Example 1 Output

```
1
```

Example 1 Description

This example corresponds to the example mentioned in Part I of the problem statement.

Example 2 Input

```
2
1
4
VBAA
```

Example 2 Output

```
B
```

Example 2 Description

This example corresponds to the example mentioned in Part II of the problem statement.

Example 3 Input

```
1
3
50
??????????????????????????????????????????????????
5
?????
10
AV?AA?VV?B
```

Example 3 Output

```
grande
72
0
```

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