# L: Magic Cube

## Time Limit: 2 seconds, Memory limit: 2G

Imagine you are holding an $n \times n \times n$ cube, which is split up into $n^3$ smaller cubes labeled from 1 to $n^3$. The orientation of the axes is left-to-right for the $x$-axis, back-to-front for the $y$-axis, and bottom-to-top for the $z$-axis. For example, a $2 \times 2 \times 2$ cube is labeled as such:

Bottom layer ($z = 1$):

```
1 2
3 4
```

Top layer ($z = 2$):

```
5 6
7 8
```

In the context of a $2 \times 2 \times 2$ cube:

- Cube 1 is at (1, 1, 1).
- Cube 2 is at (2, 1, 1).
- Cube 3 is at (1, 2, 1).
- Cube 5 is at (1, 1, 2).

Each time you rotate the cube at slice $k$ along one of the $x$-, $y$-, and $z$- axes, you are rotating the $(k + 1)$th layer along the corresponding axis, as well as all the layers after $k$ in the increasing direction of that axis.

## Input

The first line contains two integers, $n$ ($2 \leq n \leq 1\,000$) and $m$ ($1 \leq m \leq 2\,000$), the size of the cube and the number of operations.

Each of the next $m$ lines contains the information regarding an operation, and will be one of the following:

- x, $\theta$, $k$: Rotate slices $k + 1$ through slice $n$ by $\theta$ degrees counterclockwise around the $x$-axis.

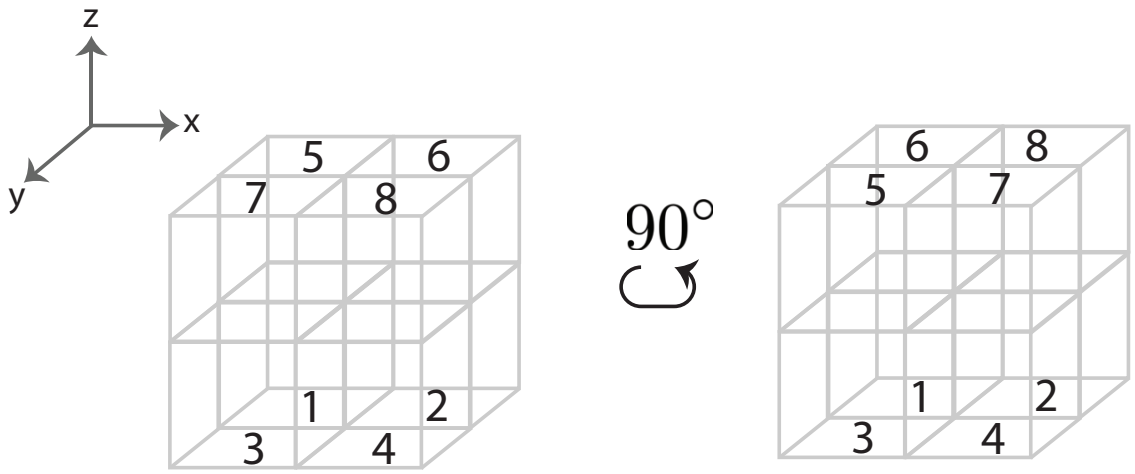



Figure 1: A $2 \times 2 \times 2$ cube after rotating at slice $z = 1$.

- `y`, $\theta$, $k$: Rotate slices $k+1$ through slice $n$ by $\theta$ degrees counterclockwise around the $y$-axis.
- `z`, $\theta$, $k$: Rotate slices $k+1$ through slice $n$ by $\theta$ degrees counterclockwise around the $z$-axis.
- `q x y z`: This is a query operation. Output which cube is at location $(x, y, z)$.

For the first three operations, it is guaranteed that $0 \leq k \leq n-1$ and $\theta \in \{90, 180, 270, 360\}$. For queries, $(x, y, z)$ denotes the query location and $1 \leq x, y, z \leq n$. It is guaranteed there will be at least one query. The cube does not reset between operations. That is, rotations are cumulative.

## Output

For each query operation, output which cube is at the given location.

| Sample Input 1 | Sample Output 1 |
|---|---|
| 2 8<br>x 360 1<br>y 360 1<br>q 1 1 2<br>z 90 1<br>x 360 1<br>q 1 2 1<br>q 2 1 1<br>q 2 2 2 | 5<br>3<br>2<br>7 |

### Sample Input 2

```
2 7
x 180 1
q 1 1 1
q 1 1 2
y 270 1
q 2 1 1
q 2 1 2
q 2 2 1
```

### Sample Output 2

```
1
5
8
4
2
```

### Sample Input 3

```
3 7
y 270 1
q 1 1 1
q 1 2 3
z 360 2
q 3 2 1
q 2 2 2
q 3 3 3
```

### Sample Output 3

```
1
4
24
14
25
```