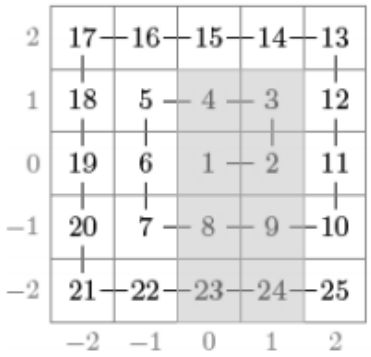
Baltic OI '16 P3 - Spiral

Time limit: 1.5s **Memory limit:** 256M

Baltic Olympiad in Informatics: 2016 Day 1, Problem 3

A grid of size $(2n+1) \times (2n+1)$ has been constructed as follows. Number 1 has been placed in the center square, number 2 has been placed to the right of it, and the following numbers have been placed along the spiral counterclockwise.

Your task is to calculate answers for q queries where the sum of numbers in a rectangular region in the grid is requested (modulo 10^9+7). For example, in the following grid $n=2$ and the sum of numbers in the gray region is 74:



Constraints

For all subtasks:

$1 \leq q \leq 100$

Subtask 1 [12%]

$1 \leq n \leq 1\,000$

Subtask 2 [15%]

$1 \leq n \leq 10^9$

$x_1 = x_2$ and $y_1 = y_2$

Subtask 3 [17%]

$1 \leq n \leq 10^5$

Subtask 4 [31%]

$1 \leq n \leq 10^9$

$x_1 = y_1 = 1$

Subtask 5 [25%]

$1 \leq n \leq 10^9$

Input Specification

The first input line contains two integers n and q: the size of the grid and the number of queries.

After this, there are q lines, each containing four integers x_1, y_1, x_2 and y_2 $(-n \leq x_1 \leq x_2 \leq n, -n \leq y_1 \leq y_2 \leq n)$. This means that you should calculate the sum of numbers in a rectangular region with corners (x_1, y_1) and (x_2, y_2).

Output Specification

You should output the answer for each query (modulo $10^9 + 7$).

Sample Input

```
2 3
0 -2 1 1
-1 0 1 0
1 2 1 2
```

Sample Output

```
74
9
14
```