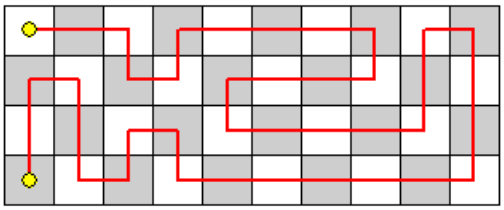
Project Euler #237: Tours on a 4 x n playing board

This problem is a programming version of Problem 237 from projecteuler.net

Let $T(m, n)$ be the number of tours over a $m \times n$ playing board such that:

- The tour starts in the top left corner.
- The tour consists of moves that are up, down, left, or right one square.
- The tour visits each square exactly once.
- The tour ends in the bottom left corner.

The diagram shows one tour over a 4×10 board:



Define $S(m, n) = \sum_{i=1}^{n} T(m, i)$. It can be shown that $T(4, 10) = 2329$ and $S(4, 10) = 3846$.

Given integers m and n, what is $S(m, n)$?
Since the answer can be quite large, express your solution modulo $10^9 + 7$.

Input Format

Each test file contains 2 lines. The first line contains m and the second n.

Constraints

- $4 \leq m \leq 8$.
- $1 \leq n \leq 5 \times 10^{18}$.

Output Format

Print the integer value of your answer.

Sample Input 0

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4
3
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Sample Output 0

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6
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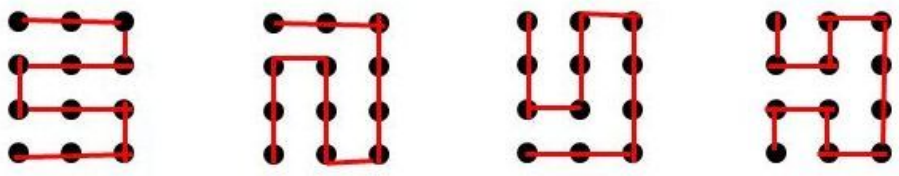
Explanation 0

It is easily seen that $T(4,1) = 1$ and $T(4,2) = 1$. Also, $T(4,3) = 4$ since the 4×3 case has the following four solutions:



Thus $S(4,3) = T(4,1) + T(4,2) + T(4,3) = 1 + 1 + 4 = 6$.