IOI Training Camp 2017 Practice Test 3

Connected Points

Consider a regular grid of $3 \times N$ points. Every point in the grid has up to eight neighboring points (see Fig. 1).

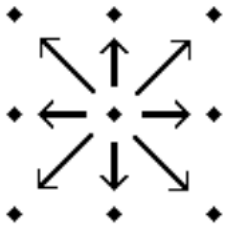

Figure 1: Neighboring points (marked by arrows).

We are interested in counting the number of different ways to connect the points of the grid to form a polygon that fulfills the following conditions:

1. The set of vertices of the polygon consists of all $3 \times N$ points.
2. Adjacent vertices of the polygon are neighboring points in the grid.
3. Each polygon is simple, i.e. there must not be any self-intersections.

Two possible polygons for $N = 6$ are given in the Fig. 2:

Figure 2: Two possible connections of points for $N = 6$.

Write a program that calculates for a given N the number of possible ways to connect the points as described modulo 1,000,000,000.

Input

The first and only line contains one positive integer N.

Output

The only line to be written contains the number of ways to connect the points modulo 1,000,000,000.

General Constraints

Unless otherwise mentioned, the following constraints are met throughout all subtasks:

- $1 \leq N \leq 10^9$

Subtasks

Subtask 1 (30 Points):

- $1 \leq N \leq 200$

Subtask 2 (40 Points):

- $1 \leq N \leq 10^5$

Subtask 3 (30 Points):

- Original constraints.

Sample Input 1

```
3
```

Sample Output 1

```
8
```

Sample Input 2

```
4
```

Sample Output 2

```
40
```

Limits

Time: 2 seconds

Memory: 512 MB