Project Euler #140: Modified Fibonacci golden nuggets

This problem is a programming version of Problem 140 from projecteuler.net

Consider the infinite polynomial series $A_G(x) = xG_1 + x^2G_2 + x^3G_3 + \ldots$, where G_k is the k^{th} term of the second-order recurrence relation $G_k = G_{k-1} + G_{k-2}$, $G_1 = 1$ and $G_2 = 4$; that is, $1, 4, 5, 9, 14, 23, \ldots$.

For this problem we shall be interested in values of x for which $A_G(x)$ is a positive integer.

The corresponding values of x for the first five natural numbers are shown below.

x	$A_G(x)$
$\frac{\sqrt{5}-1}{4}$	1
$\frac{2}{5}$	2
$\frac{\sqrt{22}-2}{6}$	3
$\frac{\sqrt{137}-5}{14}$	4
$\frac{1}{2}$	5

We shall call $A_G(x)$ a golden nugget if x is rational, because they become increasingly rarer. for example, the 20^{th} golden nugget is 211345365.

Let's denote the k^{th} golden nugget as $g(k)$; for example, $g(20) = 211345365$.

Given L and R, find $\sum_{k=L}^{R} g(k)$, i.e., $g(L) + g(L+1) + \ldots + g(R-1) + g(R)$. Since this sum can be very large, output it modulo $10^9 + 7$.

Input Format

The first line of input contains T, the number of test cases.

Each test case consists of a single line containing two space-separated integers, L and R.

Constraints

$1 \leq T \leq 40000$

In the first test case: $1 \leq L \leq R \leq 40$
In the second test case: $1 \leq L \leq R \leq 10^6$
In the third test case: $1 \leq L \leq R \leq 10^{18}$

Output Format

For each test case, output a single line containing a single integer, the answer for that test case.

Sample Input

```
2
1 2
20 20
```

Sample Output

```
7
211345365
```