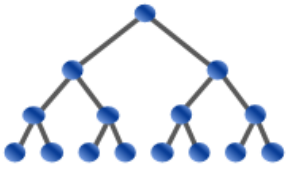
USA Computing Olympiad



USACO 2024 February Contest, Platinum
Problem 1. Lazy Cow

Contest has ended.

Log in to allow submissions in analysis mode

English (en)

Bessie is hard at work preparing test cases for the USA Cowmputing Olympiad February contest. Each minute, she can choose to not prepare any tests, expending no energy; or expend 3^{a-1} energy preparing a test cases, for some positive integer a.

Farmer John has D ($1 \le D \le 2 \cdot 10^5$) demands. For the ith demand, he tells Bessie that within the first m_i minutes, she needs to have prepared at least b_i test cases in total ($1 \le m_i \le 10^6, 1 \le b_i \le 10^{12}$).

Let e_i be the smallest amount of energy Bessie needs to spend to satisfy the first i demands. Print $e_1, \ldots, e_D$ modulo $10^9 + 7$.

INPUT FORMAT (input arrives from the terminal / stdin):

The first line contains D. The ith of the next D lines contains two space-separated integers m_i and b_i.

OUTPUT FORMAT (print output to the terminal / stdout):

Output D lines, the ith containing $e_i \bmod 10^9 + 7$.

SAMPLE INPUT:

```
4
5 11
6 10
10 15
10 30
```

SAMPLE OUTPUT:

```
21
21
25
90
```

For the first test case,

- $i = 1$: If Bessie creates $[2, 3, 2, 2, 2]$ test cases on the first 5 days, respectively, she would have expended $3^1 + 3^2 + 3^1 + 3^1 + 3^1 = 21$ units of energy and created 11 test cases by the end of day 5.
- $i = 2$: Bessie can follow the above strategy to ensure 11 test cases are created by the end of day 5, and this will automatically satisfy the second demand.
- $i = 3$: If Bessie creates $[2, 3, 2, 2, 2, 0, 1, 1, 1, 1]$ test cases on the first 10 days, respectively, she would have expended 25 units of energy and satisfied all demands. It can be shown that she cannot expend less energy.
- $i = 4$: If Bessie creates 3 test cases on each of the first 10 days she would have expended $3^2 \cdot 10 = 90$ units of energy and satisfied all demands.

For each i, it can be shown that Bessie cannot satisfy the first i demands using less energy.

SAMPLE INPUT:

```
2
100 5
100 1000000000000
```

SAMPLE OUTPUT:

```
5
627323485
```

SAMPLE INPUT:

```
20
303590 482848034083
180190 112716918480
312298 258438719980
```

671877 605558355401
662137 440411075067
257593 261569032231
766172 268433874550
8114 905639446594
209577 11155741818
227183 874665904430
896141 55422874585
728247 456681845046
193800 632739601224
443005 623200306681
330325 955479269245
377303 177279745225
880246 22559233849
58084 155169139314
813702 758370488574
929760 785245728062

SAMPLE OUTPUT:

108753959
108753959
108753959
148189797
148189797
148189797
148189797
32884410
32884410
32884410
32884410
32884410
32884410
32884410
3883759
3883759
3883759
3883759
3883759
3883759

SCORING:

- Inputs 4-5: $D \leq 100$ and $m_i \leq 100$ for all i
- Inputs 6-8: $D \leq 3000$
- Inputs 9-20: No additional constraints.

Problem credits: Brandon Wang and Claire Zhang

Contest has ended. No further submissions allowed.