

Project Euler #207: Integer partition equations

This problem is a programming version of [Problem 207](#) from [projecteuler.net](#)

For some positive integers k , there exists an integer partition of the form $4^t = 2^t + k$, where 4^t , 2^t and k are all positive integers and t is a real number.

The first two such partitions are $4^1 = 2^1 + 2$ and $4^{1.5849625\dots} = 2^{1.5849625\dots} + 6$.

Partitions where t is also an integer are called *perfect*.

For any $m > 1$ let $P(m)$ be the proportion of such partitions that are perfect with $k \leq m$. Thus $P(6) = 1/2$.

In the following table are listed some values of $P(m)$

$$P(5) = 1/1$$

$$P(10) = 1/2$$

$$P(15) = 2/3$$

$$P(20) = 1/2$$

$$P(25) = 1/2$$

$$P(30) = 2/5$$

...

$$P(180) = 1/4$$

$$P(185) = 3/13$$

Find the smallest m for which $P(m) < a/b$.

Input Format

First line of each test file contains a single integer q that is the number of queries per test file. q lines follow, with two integers a and b separated by a single space on each.

Constraints

- $1 \leq q \leq 3 \times 10^5$
- $1 \leq a < b \leq 10^{18}$

Output Format

Print exactly q lines with an answer for the corresponding query on each.

Sample Input 0

```
2
2 3
9 20
```

Sample Output 0

```
6
30
```

Explanation 0

$P(2) = P(3) = P(4) = P(5) = 1/1 > 2/3$, but $P(6) = 1/2 < 2/3$, therefore, an answer for the first query is 6.

$P(30) = 2/5$, which is the first value less than $9/20$ among all $P(m)$ where $1 < m \leq 30$.