

5122 Decomposing Fibonacci Numbers

Some Fibonacci numbers are immune to zombie attack — as prime numbers they can't be decomposed.

Fibonacci numbers are defined by the following recurrence:

$$F(n) = \begin{cases} n = 0 : 0 \\ n = 1 : 1 \\ n > 1 : F(n - 1) + F(n - 2) \end{cases}$$

You will be given an indefinite number of integer ranges of numbers that can be represented as 64-bit signed integers. Your job is to report in increasing order the Fibonacci numbers that fall within that range, as well as their base-2 logarithm and their *prime decomposition* — the prime numbers in increasing order which, when multiplied together, give the value of the Fibonacci number. If there is no Fibonacci number in the range, report that fact.



Reminder:

- the logarithm of zero is undefined, even though zero is the first Fibonacci number. Also note that, by definition, 0 and 1 have no prime factors, even though they are Fibonacci numbers.
- to calculate the base c logarithm, note that $\log_c(x) = \log(x)/\log(c)$, using on the right-hand side your favorite logarithm (common logarithm or natural logarithm).

Input

The input file contains an indeterminate number of lines consisting of two non-negative integers (lo and hi) separated by one space, given in hexadecimal format (as in `0x1a` meaning 26 in decimal). Each integer is guaranteed to fit within a 64-bit signed integer. The program terminates when it either encounters an end-of-file condition or when $lo \geq hi$.

Output

For each range in the input file, print the range and the Fibonacci number information as shown in the sample output, with each range separated by a blank line. Note that the base-2 logarithm (lg) is reported with six digits to the right of the decimal point, and that the prime factors are separated by single spaces.

Sample Input

```
0x0 0x8
0x9 0xc
0x9 0x40
0x0 0x0
```

Sample Output

Range 0 to 8:

Fib(0) = 0, lg does not exist

No prime factors

Fib(1) = 1, lg is 0.000000

No prime factors

Fib(2) = 1, lg is 0.000000

No prime factors

Fib(3) = 2, lg is 1.000000

Prime factors: 2

Fib(4) = 3, lg is 1.584963

Prime factors: 3

Fib(5) = 5, lg is 2.321928

Prime factors: 5

Fib(6) = 8, lg is 3.000000

Prime factors: 2 2 2

Range 9 to 12:

No Fibonacci numbers in the range

Range 9 to 64:

Fib(7) = 13, lg is 3.700440

Prime factors: 13

Fib(8) = 21, lg is 4.392317

Prime factors: 3 7

Fib(9) = 34, lg is 5.087463

Prime factors: 2 17

Fib(10) = 55, lg is 5.781360

Prime factors: 5 11