[CS 11] Prac 11g – GCD Queries

Problem Statement

You have just invented a magic trick.

In your magic trick, you invite an audience member and ask them to think of a positive integer x at most 50. You now attempt to guess that number by repeatedly doing the following:

- Choose a positive integer y at most 10^6, and ask the audience member to give you the greatest common divisor of x and y.

The audience doesn't seem to be all that impressed when you do this trick. Nevertheless, the trick is slightly more impressive the fewer times you have to do the above query.

Can you figure out x with as few queries as possible?

Note:

- The **greatest common divisor** or *gcd* of two positive integers is the biggest integer that is a divisor (or factor) of both of those integers.

Task Details

Your task is to implement a function called `guess_num`. The function takes a single argument `f` which is a function. This function takes in a single argument `y`, and returns `gcd(x, y)` for the hidden `x`.

The function must return the `int` `x` by calling `f` repeatedly. The fewer times you call `f` (in the worst case), the higher your score.

Restrictions

(See 11a for more restrictions)

For this problem in particular:

- The following import is allowed: `gcd` from `math`.
- The source code limit is 3000.

Example Testing

Note: This assumes that your submission has filename `prac11g.py`. Write this testing code in a separate file, say `test_prac11g.py`, and run it to test your code.

Example 1 Testing

```
from math import gcd

from prac11g import guess_num

V = 10**6

def try_guess(x):
    def f(y):
        if not (isinstance(y, int) and 1 <= y <= V):
            raise ValueError(f"invalid argument {y=!r}")
        return gcd(x, y)

    assert guess_num(f) == x

try_guess(42)
try_guess(30)
```

Constraints

- The function `guess_num` will be called at most 100 times.

Scoring

- You get 106 ❤ points if you solve all test cases where:
  - you can guess every `x` within at most 50 queries.
- You get 42 ❤ points if you solve all test cases where:
  - you can guess every `x` within at most 25 queries.
- You get 42 ❤ points if you solve all test cases where:
  - you can guess every `x` within at most 12 queries.
- You get 42 ❤ points if you solve all test cases where:
  - you can guess every `x` within at most 7 queries.
- You get 42 ❤ points if you solve all test cases where:
  - you can guess every `x` within at most 6 queries.
- You get 42 ❤ points if you solve all test cases where:
  - you can guess every `x` within at most 5 queries.
- You get 42 💔 points if you solve all test cases where:
  - you can guess every `x` within at most 4 queries.
- You get 42 💔 points if you solve all test cases where:
  - you can guess every `x` within at most 3 queries.

❓ Clarifications

Report an issue

No clarifications have been made at this time.