

# Day 9: Recursion!

## Problem Statement

Welcome to Day 9! Check out this [video on recursion](#), or jump right into the problem.

## Euclid's Algorithm for Computing the GCD of two integers

Given two integers,  $x$  and  $y$ , their  $\text{GCD}$  (greatest common divisor) can be calculated recursively using [Euclid's Algorithm](#), which essentially says that if  $x$  equals  $y$ , then  $\text{GCD}(x,y) = x$ ; otherwise,  $\text{GCD}(x,y) = \text{GCD}(x-y, y)$  if  $x > y$ . Note that this logic can be further optimized for a more efficient implementation.

Given the starter code in your editor, complete the function body so it returns the  $\text{GCD}$  of two input integers,  $x$  and  $y$ .

## Input Format

Two space-separated integers,  $x$  and  $y$ .

## Constraints

$1 \leq x,y \leq 10^6$

## Output Format

Print the  $\text{GCD}$  of  $x$  and  $y$  as an integer.

## Sample Input

1 5

## Sample Output

1

## Explanation

We are given  $x=1$  and  $y=5$ . This explanation uses the subtraction implementation mentioned in the problem description, and is outlined in pseudocode below:

```
int GCD(x,y):
  If x equals y, return x;
  Else, return GCD(x',y'), where x' = MAX(x,y) - MIN(x,y) and y' = MIN(x,y).
```

$\text{GCD}(1,5)$ :  $1 \neq 5$ , so return a call to  $\text{GCD}(5-1, 1)$ .  
 $\text{GCD}(4,1)$ :  $4 \neq 1$ , so return a call to  $\text{GCD}(4-1, 1)$ .  
 $\text{GCD}(3,1)$ :  $3 \neq 1$ , so return a call to  $\text{GCD}(3-1, 1)$ .  
 $\text{GCD}(2,1)$ :  $2 \neq 1$ , so return a call to  $\text{GCD}(2-1, 1)$ .  
 $\text{GCD}(1,1)$ :  $1 = 1$ , so we return  $x$  (which is  $1$ ).

The final return is passed back through the call stack as the return value for the original call. That is to say,  $\text{GCD}(1,1)$  returns  $1$  to  $\text{GCD}(2,1)$ , the function that originally called it.  $\text{GCD}(2,1)$  then returns it to  $\text{GCD}(3,1)$ , which returns it to  $\text{GCD}(4,1)$ , which returns it to  $\text{GCD}(1,5)$ . Thus  $\text{GCD}(1,5)$  returns a value of  $1$ , which we print as our answer.

**Note:** The algorithm used here is merely demonstrative and can be further optimized.