CS211: Algorithms & Data structures

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Assignment 2 Solution

1. Calculate the total number of primitive operations executed for the following algorithm?

Algorithm 1: GCD

Input: Two integer numbers a and b
Output: *gcd*

```
1:  m ← The minimum number of a and b.
2:  gcd ← 0
3:  i ← 2
4:  while (i ≤ m) do
5:      if a mod i = 0 and b mod i = 0 then
6:          gcd ← i
7:      end if
8:      i ← i + 1
9:  end while
10: return gcd
```

In order to estimate the running time, we will consider that the process of calculating the minimum of a or b in line 1 may take constant time c.
$\mathbf{T(n)} = c + 1 + 1 + (n-1) + 5 * (n-2) + (n-2) + 2 * (n-1) =$ **9n-5+c**

To estimate the process of selecting the minimum of two given numbers, here we include the process of selecting minimum inside the algorithm

Algorithm 2: GCD

Input: Two integer numbers a and b
Output: gcd

```
1: if a < b then
2:    m ← a
3: else
4:    m ← b
5: end if
6: gcd ← 0
7: i ← 2
8: while (i ≤ m) do
9:    if a mod i = 0 and b mod i = 0 then
10:      gcd ← i
11:   end if
12:   i ← i + 1
13: end while
14: return gcd
```

The process of calculating the minimum of a or b may here is 3.
T(n) $= 1+1+1+1+1+(n-1)+5*(n-2)+(n-2)+2*(n-1) =$ **9n-3**