

Recursive algorithms

1. This problem will ask you to write a recursive algorithm `DigitSum(n)` that takes a nonnegative integer n and returns the sum of its decimal digits. For example,

$$\text{DigitSum}(472) = 4 + 7 + 2 = 13.$$

You may use integer division and the remainder operation. For example,

$$472 \text{ div } 10 = 47, \quad 472 \text{ mod } 10 = 2.$$

- (a) What inputs can you handle immediately, without making a recursive call? What should you return for these inputs?
- (b) Suppose you already know `DigitSum(47)`. How can you use that answer to compute `DigitSum(472)`?
- (c) Write pseudocode for `DigitSum(n)` using recursion and no loops.
- (d) Trace your algorithm on $n = 3052$. Show both the calls made and the values returned.
- (e) Write your running time in the form of a recurrence.