CS 161 (Stanford, Winter 2022) Lecture 12

Pre-lecture exercises will not be collected for credit. However, you will get more out of each lecture if you do them, and they will be referenced during lecture. We recommend writing out your answers to pre-lecture exercises before class. Pre-lecture exercises usually should not take you more than 30 minutes.

Pre-Lecture Exercises

Consider the Fibonacci numbers, defined by

$$F(0) = F(1) = 1$$

and

$$F(n) = F(n-1) + F(n-2).$$

For example, the first several Fibonacci numbers are:

$$1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, \ldots$$

Consider the following divide-and-conquer algorithm to compute Fibonacci numbers.

function *Fibonacci(n)***:**
    if $n = 0$ *or* $n = 1$ **then**
        └ **return** *1*
    return *Fibonacci(n − 1) + Fibonacci(n − 2)*

1. Is this algorithm correct?

2. What is the running time of this algorithm? You don't need to find it exactly, but is it $O(n)$? $O(n^2)$? $O(n^3)$? $O(n^c)$ for any constant c?

3. How could you make this algorithm better?