University of Houston

COSC 3320: Algorithms and Data Structures
Spring 2017

Homework 1

Due January 26, at the start of class

1. (a) Prove that the sum of the first n odd natural numbers is n^2.
   (b) Prove that for every integer $n \geq 0$, $\sum_{i=0}^{n} i^2 = \frac{n(n+1)(2n+1)}{6}$.
   (c) Prove that for every integer $n \geq 0$, $\sum_{i=0}^{n} i2^i = (n-1)2^{n+1} + 2$.
   (d) Prove that for every integer $n \geq 5$, $n^2 \geq 4n + 5$.
2. The *element distinctness* problem is the problem of determining whether all the n elements of a list are distinct. Write the pseudocode for the straightforward algorithm that tests each of the n elements for distinctness, and determine its complexity.
3. (a) Prove that the function $f(n) = 6n + 9$ is $O(n)$.
   (b) Prove that the function $f(n) = 2n^3 + 2n^{7/3} + \log_2 n + 5$ is $O(n^3)$.
   (c) Prove that the function $f(n) = (\log_2 n)^2$ is $O(n)$.
   (d) Prove that the function $f(n) = 2^{n+3}$ is $\Theta(2^n)$.