

University of Houston

COSC 3320: Algorithms and Data Structures
Spring 2016

Homework 1

Due January 28, at the start of class

1. (a) Prove that the sum of the first n even non-negative integers is $n(n - 1)$.
(b) Prove that for every integer $n \geq 0$, $\sum_{i=0}^n i^3 = \frac{n^2(n+1)^2}{4}$.
(c) Prove that for every integer $n \geq 0$, $\sum_{i=0}^n i \cdot 2^i = (n - 1)2^{n+1} + 2$.
(d) Prove that for every integer $n \geq 7$, $n^2 \geq 6n + 7$.
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 $f(n) = 8n + 5$ is $O(n)$.
(b) Prove that the function $f(n) = 3n^3 + 4n^{5/3} + 2 \log n + 8$ is $O(n^3)$.
(c) Prove that the function $f(n) = 2^{n+2}$ is $\Theta(2^n)$.