Lab 1

Due: at the end of class

1 Reading

Refer to Chapter 2.1 and 3.1 of the textbook.

2 Exercises

Write out solutions to the exercises below, following the proof structures from lectures. Please include the names of everyone in your group.

1. Consider the ***searching problem***:

   Input: A sequence of n numbers $A = \langle a_1, a_2, \ldots, a_n \rangle$ and a value v.

   Output: An index i such that $v = A[i]$ or the special value **nil** if v does not appear in A.

   Write pseudocode for ***linear search***, which scans through the sequence, looking for v.

2. Write an invariant proof that shows your linear search algorithm works correctly. Write your invariant property as a property that is true for a larger and larger piece of the problem as the algorithm progresses. Follow the invariant proof structure to show the three necessary conditions for your property to be true: initialization, maintenance, and termination. (Use the bottom half of the back if you need more space.)

   Reminder: the invariant property should **not** be expressed in future tense. It should be true at each loop of the pseudocode.

Apply the mathematical definition of $O()$ to analyze if the following equations are correct. Show your work in plugging the two functions into the $O()$ defintion. If you agree with the equation, give a specific value for c and n_0 that supports the definition. If you disagree with the equation, state that it is incorrect and explain why no c, n_0 pair exists to satisfy the definition.

3. $n^3 + 20n + 1 = O(n^3)$

4. $n \lg n + 3n^2 = O(n \lg n)$

5. $.01n^2 = O(n^2)$

6. $n^2 + 8 \lg n + 3n = \Theta(n^2)$ (That's theta, the tight bound.)