CS3114 Fall 2011 Homework Assignment 1
Due Tuesday, September 20 at 11pm
50 points

1. [Estimation problem] How many words are in the CS3114 textbook?

2.

(a) Suppose that an algorithm has time complexity $\mathbf{T}(n) = 2n^2$, and that executing an implementation of it on a particular machine takes t seconds for n inputs. Now suppose that we are presented with a machine that is 32 times as fast. How many inputs could we process on the new machine in t seconds?

(b) Another algorithm has time complexity $\mathbf{T}(n) = 16n$. Executing an implementation of it on a particular machine takes t seconds for n inputs. Given a new machine that is 32 times as fast, how many inputs could we process in t seconds?

3. For each of the following pairs of functions, either $f(n)$ is in $\mathrm{O}(g(n))$, $f(n)$ is in $\Omega(g(n))$, or $f(n) = \Theta(g(n))$. For each pair, determine which relationship is correct. Justify your answer, using the method of limits discussed in Section 3.4.5.

(a) $f(n) = \log n^2$; $g(n) = \log n + 5$.

(b) $f(n) = n$; $g(n) = log^2 n$.

(c) $f(n) = n \log n + n$; $g(n) = \log n$.

(d) $f(n) = \log n^2$; $g(n) = (\log n)^2$.

(e) $f(n) = 10$; $g(n) = \log 10$.

4. Use the space equation of Section 4.1.3 to determine the break-even point for an array-based list and linked list implementation for lists when the sizes for the data field, a pointer, and the array-based list's array are as specified.

(a) The data field is eight bytes, a pointer is four bytes, and the array holds twenty elements.

(b) The data field is one byte, a pointer is four bytes, and the array holds thirty elements.

5. Let Q be a non-empty queue, and let S be an empty stack. Using only the stack and queue ADT functions and a single element variable X, write an algorithm to reverse the order of the elements in Q.