CS 152h: Data Structures Homework #2

ALGORITHM ANALYSIS

2.1 Order the following functions by growth rate: N, $\sqrt{N}$, $N^{1.5}$, N^2, $N \log N$, $N \log \log N$, $N \log^2 N$, $N \log(N^2)$, $2/N$, 2^N, $2^{N/2}$, 37, $N^2 \log N$, N^3. Indicate which functions grow at the same rate.

2.2 Suppose $T_1(N) = O(f(N))$ and $T_2(N) = O(f(N))$. Which of the following are true?

(a) $T_1(N) + T_2(N) = O(f(N))$

(b) $T_1(N) - T_2(N) = o(f(N))$

(c) $\frac{T_1(N)}{T_2(N)} = O(1)$

(d) $T_1(N) = O(T_2(N))$

2.4 Prove that for any constant k, $\log^k N = o(N)$.

2.10 Determine, for the typical algorithms that you use to perform calculations by hand, the running time to do the following:

(a) Add two N-digit integers.

(b) Multiply tow N-digit integers.

(c) Divide two N-digit integers.

3.37 Suppose that a singly linked list is implemented with both a header and a tail node. Describe constant-time algorithms to

(a) Insert item x before position p (given by an iterator).

(b) Remove the item stored at position p (given by an iterator).