CSE 326: Data Structures
Assignment #1
September 30, 2009
due: Friday, October 9

1. Write a procedure `LLDelete` that is the companion of `LLInsert` of Algorithms 1.5 and 1.6. `LLDelete` takes a key K and a linked list, and deletes the first cell containing key K on the list, if such a cell exists, otherwise it does nothing. As in `LLInsert`, you should assume that the linked list is ordered in nondecreasing key order.

   (a) Write `LLDelete` using locatives.

   (b) Write `LLDelete` without locatives.

2. Page 39, exercise 23(b).

3. This problem gives an orthogonal view of comparative running times from that given in lecture. Be sure to look at the patterns in your table when you have completed it.

   For each function $f(n)$ and time t in the following table, determine the largest size n of a problem that can be solved in time t, assuming that the algorithm to solve the problem takes $f(n)$ microseconds. For large entries (say, those that warrant scientific notation), an estimate is sufficient. For one of the rows, you will not be able to solve it analytically, and will need a calculator or small program.

	1 second	1 minute	1 hour	1 day	1 month	1 year
$1000 \log_2 n$						
$100n$						
$100n \log_2 n$						
$10n^2$						
n^3						
$\frac{1}{10} \cdot 2^n$						

4. (a) Prove that $n \ln n \in O(n^{1+\epsilon})$, for any constant $\epsilon > 0$. (Hint: choose $c = 1$. I see a way of doing this using derivatives, and there are probably other ways as well. If you have trouble with this, start with the case $\epsilon = 1$.)

   (b) Prove that $n \ln n \notin O(n)$.

5. Let $T(n)$ be the running time of the following procedure on input n. Find a function $f(n)$ such that $T(n) \in \Theta(f(n))$, and justify your answer.

procedure triple(integer n):
  for i **from** 1 **to** n **do**
    for j **from** 3 **to** $n/2$ **do**
      for k **from** j **to** $j + 100$ **do**
        if $j - k$ is even
          then $x \leftarrow x + 1$;
          else $x \leftarrow 2 * x$;

6. Let $T(n)$ be the running time of the following procedure on input n. Find a function $f(n)$ such that $T(n) \in \Theta(f(n))$, and justify your answer.

procedure double(integer n):
  for i **from** 1 **to** n **do**
    for j **from** $i + 1$ **to** n **do**
      $x \leftarrow x + 1$;