CSE 332: Data Abstractions
Assignment #1
June 20, 2011
due: Monday, June 27, 10:50 a.m.

There are 2 pages to this assignment.

1. This problem gives an orthogonal view of comparative running times from that given
   in Figure 2.2 of the textbook. 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						
$\frac{1}{10} \cdot 2^n$						

2. Prove or disprove: $n \log_{10} n \in \Theta(n \log_2 n)$.

3. (a) Prove that $n \ln n \in O(n^{1+\epsilon})$, for any constant real number $\epsilon > 0$. (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 $n \ln n \notin O(n)$.

4. 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 $x \leftarrow 2 * x$;

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 double(integer n):
    for i from 1 to n do
        for j from i + 1 to n do
            x ← x + 1;
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