Assignment 1

due Friday, January 14, 2005

1. Suppose that algorithm $A$ uses $\lceil 15n\sqrt{n} \rceil$ operations while algorithm $B$ uses $2n^3$ operations. Determine the value $n_0$ such that $A$ is better than $B$ for all $n \geq n_0$. [4 points]

2. exercise 3.1-4, p 50. Additionally, is $2^{2n+1} = O(2^{2n})$? [4 points]

3. exercise 3.2, p 58 [8 points]

4. exercise 3-3, part a (not part b), p 58. NEW: ignore all functions involving $\log^*$ or a factorial (such as $(\log n)!$). [8 points]

5. An algorithm takes $0.2\mu$ for input size 100 (this allows you to determine the constant, which will be different in each case). How large of an input can be solved in 3 minutes if the algorithm is . . . ?
   (a) $\Theta(n)$
   (b) $\Theta(n \log n)$
   (c) $\Theta(n^3)$
   (d) $\Theta(2^n)$
   [8 points]

6. Describe how to find the minimum and maximum of an array of $n$ elements with at most $\frac{3}{7}n$ element comparisons. (Do not count comparisons needed for the array indices.) [4 points]

Total: 36 points

Notes:

• A $\mu$ is $1/1000$ of a second.
• For $\Theta(n \log n)$, you may find an approximate solution, but try to be as accurate as you can stand.
• Hint for Q6: form $\lceil \frac{n}{2} \rceil$ pairs, from each pair find candidate min and candidate max for the whole list.