CIS 313, Introduction to Data Structures
Winter 2007

Assignment 1

due Friday, January 19, 2007

1. Suppose that algorithm $\mathcal{A}$ uses $162n^4$ operations while algorithm $\mathcal{B}$ uses $2n^7$ operations. Determine the value n_0 such that $\mathcal{A}$ is as fast or faster than $\mathcal{B}$ for all $n \geq n_0$. **[4 points]**

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

3. exercise 3.2, p 58 **[8 points]**

4. exercise 3-3, part a (**not** part b), p 58. **[8 points]**

5. An algorithm takes 0.2μ for input size 10 (this allows you to determine the constant, which will be different in each case). How long does it take to finish on an input of size 500 if the algorithm's run time 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 $\frac{3}{2}n$ element comparisons. (Do not count comparisons needed for the array indices.) **[4 points]**

Total: 36 points

Notes:

- In Q3, ignore any function involving a $\lg^*$.
- A μ is 1/1000 of a second.
- Hint for Q6: form $\lceil \frac{n}{2} \rceil$ pairs, from each pair find candidate min and candidate max for the whole list.