CIS 313, Intermediate Data Structures
Winter 2010

Assignment 1

due Friday, January 15, 2010

1. Suppose that algorithm $\mathcal{A}$ uses $293907 \cdot n^3$ operations while algorithm $\mathcal{B}$ uses $3 \cdot n^5$ 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 53. Additionally, is $2^{2^{n+1}} = O(2^{2^n})$? **[4 points]**

3. exercise 3-2, p 61. **[8 points]**

4. exercise 3-3, part a (**not** part b), pp 61-62. **[8 points]**

5. An algorithm takes $0.2ms$ for input size 10 (this allows you to determine the constant c, which will be different in each case). How large of an input size n can be solved in an hour if the run time of the algorithm is ... ?

   (a) $c\ n$
   (b) $c\ n \log n$
   (c) $c\ n^3$
   (d) $c\ 2^n$

   [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, just comparisons of array elements.) **[4 points]**

Total: 36 points

Notes:

- For Q2, we are **not** asking you to do questions 1 through 4. Just question 4 of section 3.1.
- In Q4, ignore any function involving a $\lg^*$.
- An ms 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.