CIS 313, Intermediate Data Structures  
Winter 2010

Assignment 1

due Friday, January 15, 2010

1. Suppose that algorithm \( A \) uses \( 293907 \cdot n^3 \) operations while algorithm \( B \) uses \( 3 \cdot n^5 \) operations. Determine the value \( n_0 \) such that \( A \) is as fast or faster than \( B \) for all \( n \geq n_0 \). [4 points]

2. exercise 3.1-4, p 53. Additionally, is \( 2^{2n+1} = O(2^{2n}) \)? [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 0.2\( ms \) 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 \( \ldots ? \)
   
   (a) \( c \cdot n \)
   (b) \( c \cdot n \log n \)
   (c) \( c \cdot n^3 \)
   (d) \( c \cdot 2^n \)
   
   [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 \( \lg^* \).
- 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.