CIS 313 Introduction to Data Structures
Winter 2007

Assignment 7

due Friday, March 17, 2007

1. Exercise 7-3, parts b and c **only**, pp 161-162. [**6 points**]
2. Given a sequence S of n comparable elements and a positive integer k, describe an $O(n)$ method for finding the k items whose **rank** is closest to that of the median. [**6 points**]
3. Given a sequence S of n comparable elements and a positive integer k, describe an $O(n)$ method for finding the k items whose **value** is closest to that of the median. [**8 points**]
4. You are given a sequence of n elements to sort. The input sequence consists of n/k subsequences, each containing k elements. The elements in a given subsequence are all smaller than the elements in the succeeding subsequence and larger than the elements in the preceeding subsequence. Thus, all that is needed to sort the whole sequence of length n is to sort the k elements in each of the n/k subsequences. Show an $\Omega(n \lg k)$ **lower bound** on the number of comparisons needed to solve this. (This is exercise 8.1-4, p 168.) [**8 points**]
5. Exercise 8.3-4, p 173. [**6 points**]

Total: 20 points

Notes:

- *Q2:* An item's rank is its relative position on the list. The smallest element has rank 1, the largest rank n, and the median rank n/2.
- *Q3:* Note that you may be returning different values than in the previous question. You may want to find the median first, then look at the difference between each element and the median. Find the k smallest of these latter values.
- *Q4:* It is **not sufficient** to simply combine the lower bounds for the individual subsequences.
- *Q5:* Represent a value k $(0 \leq k < n^2)$ as a pair (i, j), where $0 \leq i, j < n$.