Assignment 7

due Friday, March 11, 2005

1. 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]

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 value is closest to that of the median. [8 points]

3. 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]

4. Exercise 8.3-4, p 173.

Total: 22 points

Notes:

- $Q1$: 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 $n/2$.
- $Q2$: Note that you may be returning different values than in the previous question.
- $Q3$: It is not sufficient to simply combine the lower bounds for the individual subsequences.
- $Q4$: Represent a value $k$ ($0 \leq k < n^2$) as a pair $(i, j)$, where $0 \leq i, j < n$. 