

# CSE 413, Analysis of Algorithms

Fall Semester, 2004

## Assignment 3: Data Structures

**Due Date:** Sept. 27, 2004 (at the beginning of CSE 413 class)

**Note:** The problems in this assignment are quite difficult! Please start working on them as early as possible, and ask questions if clarifications or further explanations are needed. The techniques discussed in class on adding and maintaining additional information in data structures are essential for the solutions of problems 2, 3, and 4.

1. Given a min-heap  $H$  of  $n$  keys stored in an array and an integer  $k \geq 1$ , design an  $O(k \log k)$  time algorithm to find the  $k$ -th smallest key in  $H$ . Note that  $k$  can be much smaller than  $n$ , and thus you cannot assume that  $\log k = \Theta(\log n)$  in general. **(20 points)**

**Hint:** Your algorithm may make use of a heap data structure, say  $H'$ . What would your heap  $H'$  contain and how would your algorithm make use of it?

2. Exercise 4.16, page 88. **(20 points)**
3. Exercise 4.26, page 89. **(20 points)**
4. Exercise 4.28, page 89. **(20 points)**

**Total Points:** 80