

# CSCI 303 Algorithms

## Homework 5

Due: 11:00 in class, October 9, 2001

1. Heap initialization of an input array 10, 12, 1, 14, 6, 5, 8, 15, 3, 9, 7, 4, 11, 13, 2.
  - (a) (5 points) Show the result of inserting the numbers, one at a time, into an initially empty min heap.
  - (b) (5 points) Use the linear-time heap initialization algorithm to build a min heap using the same input.
  
2. A min-max heap is a data structure that supports both DeleteMin and DeleteMax in  $O(\log n)$  per operation. The structure is identical to a regular heap, but the heap property is that for any node  $x$  at even depth, the key in  $x$  is the smallest in its subtree, and for any node  $x$  at odd depth, the key in  $x$  is the largest in its subtree. Assume that the root is at even depth of 0. For example, array 6, 81, 87, 14, 17, 12, 28, 71, 25, 80, 20, 52, 78, 31, 42, 31, 59, 16, 24, 79, 63, 18, 19, 32, 13, 15, 48 represents a min-max heap.
  - (a) (2 points) How do you find the minimum in a min-max heap?
  - (b) (3 points) Describe how DeleteMin can be done in  $O(\log n)$  time.
  - (c) (2 points) How do you find the maximum in a min-max heap?
  - (d) (3 points) Describe how DeleteMax can be done in  $O(\log n)$  time.