58131 Data Structures (Spring 2009)

Homework 8 (16–20 March)

The deadline for finishing Round 5 of TRAKLA2 problems is **Sunday 22 March**!

1. Give an algorithm for finding the *smallest* element in a max-heap. Assume the usual array implementation for the heap. The algorithm should examine as few elements in the heap as possible.

2. Give an iterative (*i.e.* non-recursive) version of the algorithm MIN-HEAPIFY for min-heaps.

3. In a 3-ary heap, the internal nodes have three children instead of two as in the binary heap (as usual, the last node can have less children).
   How do you generalise the array representation of a binary heap to the case of a 3-ary heap?
   Write pseudocode for the min-3-ary-heap operations MIN-HEAPIFY, INSERT and DELETE-MIN.
   What are the running times of the operations?

4. The inverse operation to sorting is shuffling. It is needed in efficiency tests and playing card programmes.
   Write a Java programme that given as input a number \( n \) stores the integers \( 1, \ldots, n \) in random order into an array \( T \) and prints the array \( T \). All orderings should have equal probability and the running time of the algorithm should be \( O(n) \). Use the Java Math class function \( \text{Math.random()} \).