

CS 223

Laboratory Assignment #2

Due: at the end of the lab in Week 6 (Feb 20, 09)

The Problems

1. Prove that a heap with n nodes has height $\lceil \log n \rceil$.
2. Given an array of integers $A[0..n-1]$, implement the heapsort algorithm, use it to find the median of $A[0..n-1]$. Also, implement the linear median selection algorithm to find the median of $A[0..n-1]$.

Compare the actual running times of the two programs, using $n = 32000$. If the difference is not obvious, increase n , until the difference becomes noticeable. You can initiate A with random integers, say, with the following loop in Java

```
for(i=0;i<n;i++) {  
    A[i]=rand()%n;  
}
```

3. In class, we covered Max-key Priority Queue. In this lab assignment you need to implement a Min-key Priority Queue. Given an array of integers $A[0..n-1]$, say $n = 32$, implement the min-key priority queue which supports the following 4 functions:

insert(A,x) — insert a node with key x into the priority queue.

min(A) — return, from the priority queue, the element with the minimum key.

delete-min(A) — delete, from the priority queue, the element with the minimum key.

decrease-key(A,x,k) — decrease the key x 's value to k .

Run each function at least twice, show the output each time. If you want, you can modify the class PQ on page 375 (Sedgwick), like

```
class PQ //ADT interface
{ //implementations and private members hidden
    PQ(int)
    boolean empty()
    void insert(ITEM)
    ITEM getmin()
    ...
    ...
};
```