

COMP 785 Advanced Algorithms Spring 2007 Assignment 5

Due Thursday, April 19

Do the following problems from the text.

6.1-2

6.2-1

6.3

6.4-3

6.5-7

7.1-3

7.2-4

7.3-1

7.4-2

7.5 parts a, b, and d

8.1-1

8.2-2

8.3-1

9.1-1

9.2-4

Programming Problems

A. Let *Item* be a record (structure, object, ...) type that has fields (data members, ...) *time* and *job*, both integers. You will implement operations on priority queues whose elements are *Item* records. The key is the *time* field and the root of the heap is the record with the smallest key value. So the heap property here is:

For every node *i* other than the root, $A[\text{Parent}[i]] \leq A[i]$.

Where *S* is a priority queue of *Item* records and *x* is an *Item*, the operations you are to implement are:

INSERT(*S*,*x*) – insert *x* into *S*

MINIMUM(*S*) – return the element of *S* with the smallest key

EXTRACT-MIN(*S*) – remove and return the element of *S* with the smallest key

(Note that *MINIMUM* and *EXTRACT-MIN* are analogues of *MAXIMUM* and *EXTRACT-MAX* given in your text and in the course notes.) You might redefine *INSERT* so that it takes three arguments: *S*, *x.time*, and *x.job*. Test your program with the following data.

insert (5,50) – this is a structure with time = 5 and job = 50

insert (4,40)

insert (3,30)

insert (6,60)

MINIMUM

EXTRACT-MIN

insert (2,20)

EXTRACT-MIN

EXTRACT-MIN

EXTRACT-MIN

EXTRACT-MIN

EXTRACT-MIN

Submit your program to the digital drop box in Blackboard.

B. Implement the RANDOMIZED-SELECT algorithm on p.186 of the text, and use it to find the 4th order statistic in the array

$A = \langle 3, 2, 9, 0, 7, 5, 4, 8, 6, 1 \rangle$

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