CS 315 Week 8 (March 18 and 20) summary and review questions

Topics covered

- Priority queue as a ADT
- Binary heap – definition
- Insert and Deletemin algorithms

SUMMARY:

- ADT priority queue supports – Insert, Deletemin as main operations.
- Other operations – merge, increasekey, decreasekey etc.
- Applications: scheduling of tasks with priority, sorting
- Definition of a binary ***min-heap*** – a complete tree in which each key is <= its children. Max-heap is similar except the inequality is reversed.
- Although heap is viewed conceptually as a tree, there is no pointer connecting the parent node to its children. The connection between parent and child is given by a simple formula: the children of node j are 2*j and 2*j+1. The parent of node j is j / 2.
- Algorithms for **insert** and **deletemin** (see the class notes as well as the text). Our presentation closes follows the text.
- Proof of O(log n) time complexity for **insert** and **deletemin**.

REVIEW QUESTIONS:

1) Define the following terms: (a) heap property (b) complete binary tree (c) full binary tree.

2) If a sorted array is used to implement a priority queue, what is the complexity of the operations INSERT and DELETEMIN?

3) Draw a heap with 12 nodes in the form of a binary tree.

3) What is the result of inserting 12 into the heap of Figure 6.5 (a), page 217. What is the result of performing DeleteMin on the resulting heap.

4) Let A be an array of integers in which some keys are stored in indices 1 to k. Write a procedure that takes as input A and k, and determines if A[1 : k] forms a min-heap. What is the time complexity of this algorithm? Hint: Check for each node that its key is >= its parent key.

5) How many different min-heaps can you form using the keys 1, 2, 3,4, 5, 6 and 7?

6) What is the smallest (largest) number of nodes in a heap of height 6? What is the height of a heap with 200 nodes?

7) Exercise 6.1, 6.2, 6.3