Instructor: Dr. Sartaj Sahni
Summer, 2001

Advanced Data Structures
(COP 5536 /NTU AD 711R)
Final Exam

CLOSED BOOK
90 Minutes
One week after last lecture.

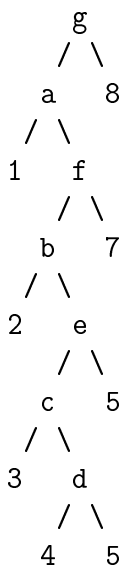
Name: _____

SSN: _____

Site Number: _____

NOTE: All answers will be graded on correctness, efficiency, clarity, elegance and other normal criteria that determine quality. The points assigned to each question are provided in parentheses.

1. (8) Consider the following splay tree:



Perform a search for element d under the assumption this is a $Top-down$ splay tree. Show the tree(s) after each step of the splay.

2. (10) Insert the following keys into an initially empty instance of Patricia:

$$0101, 0010, 0011, 1011, 1000, 1101.$$

Draw the Patricia instance following each insertion. Then delete the key 0101, and draw the resulting instance.

3. (8) About priority search trees:

   (a) (4) Draw a radix priority search tree with the following pairs. Assume that the key range is [0..24].

   (10,12), (8,16), (3,4), (23,6), (13,18), (17,9).

   (b) (4) insert (11,11) and draw the resulting tree.

4. (10) Consider a segment tree with range $[0..k]$, where k is an integer,

   (a) (5) Describe how a horizontal line segment is inserted into a segment tree. What is the time complexity? Why?
   Assume that the two endpoints of the horizontal line segment are integers within the range $[0..k]$ and each leaf node of the segment tree covers an integer range.

   (b) (5) If a segment tree contains n horizontal line segments, describe how to report all horizontal line segments that intersect a given vertical line.
   What is the time complexity? Why?

5. (7)Let Q be a quad-tree that represents a digitized binary image of a region, where the pixels representing the water surface are black. Describe how the area of the water surface may be computed. Assume that each pixel represents one unit of area.

6. (7) Explain how a Bloom filter is used in conjunction with differential files and give an advantage of using a Bloom filter in this way (your answer should not exceed one page)