Instructor: Dr. Sartaj Sahni
Summer, 2002

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

CLOSED BOOK
70 Minutes

Name: _____

NOTE:
1. **For all problems, use only the algorithms discussed in class/text.**
2. All answers will be graded on correctness, efficiency, clarity, elegance and other normal criteria that determine quality.
3. The points assigned to each question are provided in parentheses.

1. (10) For B-trees,

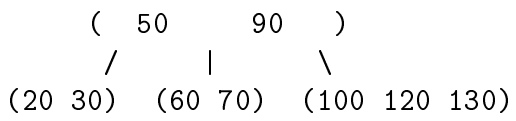
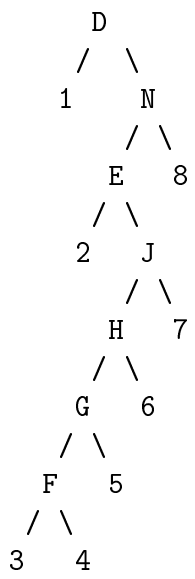


figure 1 B-tree of order 5.

(a) (6) Delete the following sequence of keys from the above B-tree of order 5 (figure 1): 50, 100, and 130 (Show each step)

(b) (4) Derive the maximum number of keys that can be stored from level 1 to level L of a B-tree of order M (notice that the root is in level 1).

2. (10) Consider the following splay tree:



(a) (5) Perform a search for the element F under the assumption that this is a Top-down splay tree, show each step of the splay that is done.

(b) (5) Do part (a) assuming a Bottom-up splay tree, show each step of the splay that is done.

3. (10) For *Patricia*,

   (a) (6) *Insert* the following keys into an initially empty instance of Patricia:

   0010, 0011, 0100, 1010, 1011, 1111

   Draw the Patricia instance following each insertion.

   (b) (4) *Delete* the key 1010 from the result of part (a) and draw the resulting instance, showing each step.

4. (8) For the *min radix search tree* (RPST) with the range [0,24),

   (a) (5) Start with an empty min RPST, *insert* the following sequence of keys: (3,7), (6,13), (11,3), (3,2), and (4,9), showing each step. The elements x and y of key (x, y) are the *search* and *priority* key values, respectively.

   (b) (3) *Delete* (3,2) from the result RPST of part (a).

5. (12) You are given a 2^k-by-2^k binary image. We are going to represent the image using a *quadtree*.

   (a) (4) Specify how to *locate* the node for pixel [i,j] by following a path from the root of the quadtree.

   (b) (4) Describe how you can *initialize* the quadtree.

   (c) (4) Describe how you can perform *counterclockwise rotation* by 90 degrees.