CIS 435: Homework 6(Due: April 20, 2004)

Solve problems 1-3 (Group 1) and either Problem 4 (Group 2) or Problem 5 (Group 3).

Problem 1. (8 points)

Starting with an initially empty red-black tree, insert in sequence keys 200, 100, 50, 300, 400, and 350. Show all steps including the intermediate steps before and after a FIX-Insert operation (if such is necessary).

Problem 2. (4 points)

For the following tree in Figure (1), list the nodes in the order visited in a preorder, inorder and postorder traversal.

Problem 3. (8 points)

Starting with the red-black tree of Figure (1) delete one after the other the following integer keys: 400, 500, 300, 1500, 1000, 800. Show all steps including the intermediate steps before and after a FIX-Delete operation (if such is necessary). Note that the .PDF version of the Figure may be drawn rotated by 90 for reasons unknown.

Problem 4. (30 points)

(a) For the following graph in Figure (3), perform Depth First Search starting from vertex 1 (use the smallest-to-largest vertex index convention to visit the adjacency list of a vertex).

(i) Classify every edge for that search traversal as a tree edge (label it **t**), a back edge (label it **b**), a forward edge (label it **f**), or a cross edge (label it **c**). (10 points)

(ii) For each vertex v label v with $D[v]$ and $F[v]$ to indicate the order of first and last visit of every vertex. (10 points)

(b) TRUE or FALSE? Justify your answer. *In any red-black tree T an Insert(T,x) followed by a Delete(T,x) leaves the tree in exactly the same state it was before x was Inserted and Deleted.* Note. x is not in tree T before the insertion is performed. "same state" means that nodes have same keys and same children/orientation before and after the two operations are performed.

Problem 5. (30 points + 50 BONUS POINTS)

Read details in the module on how to claim and get the bonus points. Do the Programming Module that is outlined in the electronic handout available at the course web page
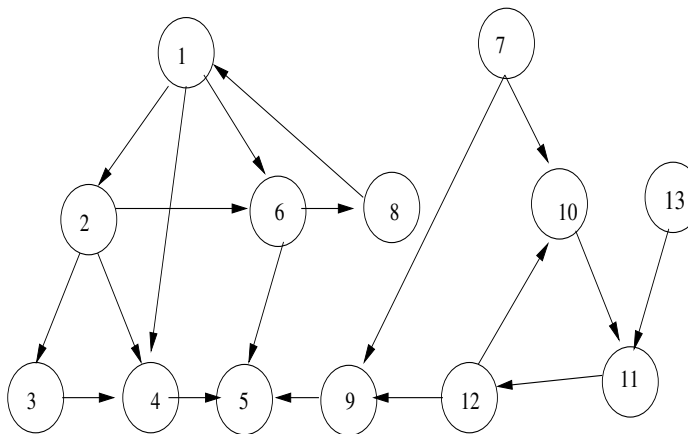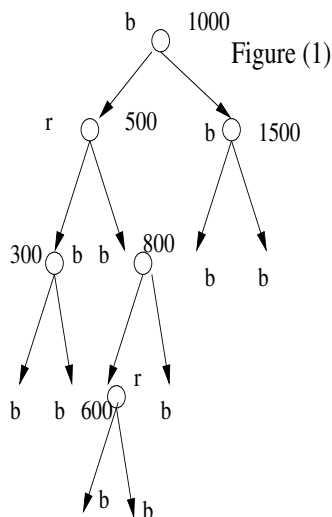
`http://www.cs.njit.edu/~alexg/courses/cis435/handouts/phw6.ps` or
`http://www.cs.njit.edu/~alexg/courses/cis435/handouts/phw6.pdf`

Figure (1)

Figure (2)