CS4580 Advanced Data Structures

Homework 1 (Individual Assignment)

1.

Start with an empty red-black tree and insert the following keys in the given order: 15,14,13,12,11,10,9,8,7,6,5,4,3,2,1.

Draw figures depicting your tree immediately after each insertion and following the rebalancing rotation or color change (if any). Label all nodes with their color and identify the rotation type (if any) that is done.

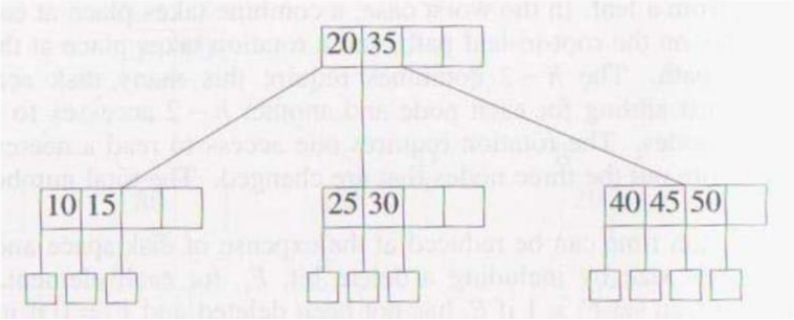
2.

a) Insert elements with keys 36, 42, 13, and 92. One at a time into the order-5 B-tree of figure below. Show the new tree after each element is inserted. Do the insertion using the insertion process described in the class.

b) Assuming that the tree is kept on a disk and one node may be retrieved at a time, how many disk accesses are needed to make each insertion? State any assumptions you make.

c) Delete the elements with keys 45, 40, 10, and 25 from the order-5 B-tree of figure below. show the tree following each deletion. The deletions are to be performed using the deletion process described in the class.

d) How many disk accesses are made for each of the deletions?



3.

a) Construct an arbitrary splay tree with height 6 that has 10 elements. Your tree should have an element with value 7 at level 6.

b) Perform the split operation with respect to the element with value 7, showing each step.