Data Structures and Algorithms – (COMP SCI 2C03)
Winter 2021
Tutorial-5

March 1, 2021

1. Give five orderings of the keys A X C S E R H that, when inserted into an initially empty BST, produce the best-case tree.

2. Suppose that a certain BST has keys that are integers between 1 and 10, and we search for 5. Which sequence below cannot be the sequence of keys examined?

   a. 10, 9, 8, 7, 6, 5

   b. 4, 10, 8, 7, 5

   c. 1, 10, 2, 9, 3, 8, 4, 7, 6, 5

   d. 2, 7, 3, 8, 4, 5

   e. 1, 2, 10, 4, 8, 5

3. Consider the BST given in Figure 1. Draw the resulting tree when

   a. The key H is inserted into it.

   b. Delete the key T from the tree obtained after (a).

   c. Give the sequence of nodes visited to compute the minimum and maximum operations, on the tree obtained from (b).

   d. Give the sequence of nodes visited to compute the floor and ceiling operations, on the tree obtained from (b).

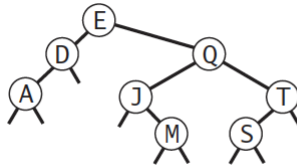   e. What is the `rank` of the node Q in the tree obtained from (b).

Figure 1: Question 3

4. Draw the (i) 2-3 tree and (ii) red-black tree that results when you insert the keys Y L P M X H C R A E S in that order into an initially empty tree.

5. Find an insertion order for the keys S E A R C H X M that leads to a 2-3 tree of height 1.

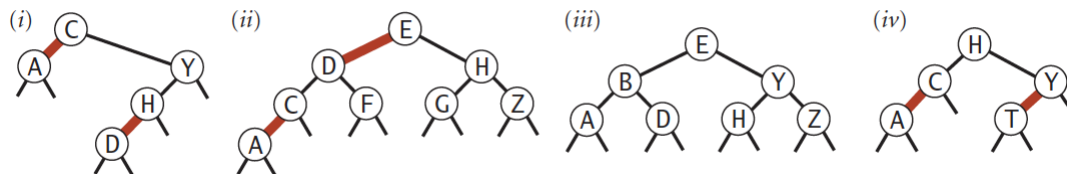6. Which of the trees given in Figure 2 are red-black BSTs?

Figure 2: Question 6

7. Draw the red-black BST that results when you insert letters A through K in order into an initially empty tree, then describe what happens in general when trees are built by insertion of keys in ascending order.

8. Draw the red-black BST that results when you insert letters A through K in reverse order into an initially empty tree, then describe what happens in general when trees are built by insertion of keys in descending order.