

Introduction to Algorithms Assignment2

Due Date: 2019/12/12 12:00:00

Red-black tree(p.308)

Rule:

1. Every node is either red or black.
2. The root is black.
3. Every leaf (NIL) is black.
4. If a node is red, then both its children are black.
5. For each node, all simple paths from the node to descendant leaves contain the same number of black nodes.

Display:

Display the tree using Inorder traversal(p.288)

Output format: (1) node value (2) parent of node (3) node color

P.S.

(1) **Output empty (blank) value for the parent of root**

(2) **No output for NIL(leaf)**

1. Insert node:

Input:

2 (number of works)

1(insert)

5 11 9 7 6 12 5 4 1

1

2 3

Output:

Insert: 5, 11, 9, 7, 6, 12, 5, 4, 1

key: 1 parent: 4 color: red

key: 4 parent: 5 color: black

key: 5 parent: 6 color: red

key: 5 parent: 5 color: black

key: 6 parent: color: black

key: 7 parent: 9 color: black

key: 9 parent: 6 color: red

key: 11 parent: 9 color: black

key: 12 parent: 11 color: red

Insert: 2, 3

key: 1 parent: 2 color: black
key: 2 parent: 5 color: red
key: 3 parent: 4 color: red
key: 4 parent: 2 color: black
key: 5 parent: 6 color: black
key: 5 parent: 5 color: black
key: 6 parent: color: black
key: 7 parent: 9 color: black
key: 9 parent: 6 color: black
key: 11 parent: 9 color: black
key: 12 parent: 11 color: red

2. Delete node:

Input:

2 (number of works)

1

5 11 9 7 6 12 5 4 1

2 (delete)

11 5

Output:

Insert: 5, 11, 9, 7, 6, 12, 5, 4, 1

key: 1 parent: 4 color: red

key: 4 parent: 5 color: black

key: 5 parent: 6 color: red

key: 5 parent: 5 color: black

key: 6 parent: color: black

key: 7 parent: 9 color: black

key: 9 parent: 6 color: red

key: 11 parent: 9 color: black

key: 12 parent: 11 color: red

Delete: 11, 5

key: 1 parent: 4 color: black

key: 4 parent: 6 color: red

key: 5 parent: 4 color: black

key: 6 parent: color: black

key: 7 parent: 9 color: black

key: 9 parent: 6 color: red

key: 12 parent: 9 color: black

(Only provide the means of input and output. Please check format of **input file and output display**.)

Rule of programing and the dataset:

- (1) The number of tree nodes is less than 100.
- (2) Dataset will always insert first.
- (3) Dataset will not delete non-exist number.
- (4) All element type is Integer.
- (5) Output do not break the rule will be right.
- (6) Cannot use not standard header file(e.g <bits/stdc++>) or you should attach on your zip
- (7) Input file and output display automatically and the relative path is beside the main program.