

Title: Balanced search trees and hashing

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Section: 1

Homework: 4

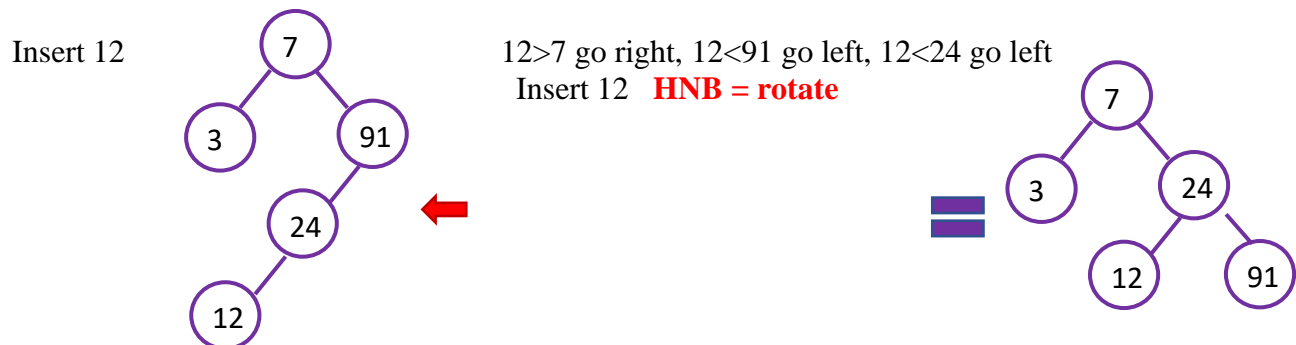
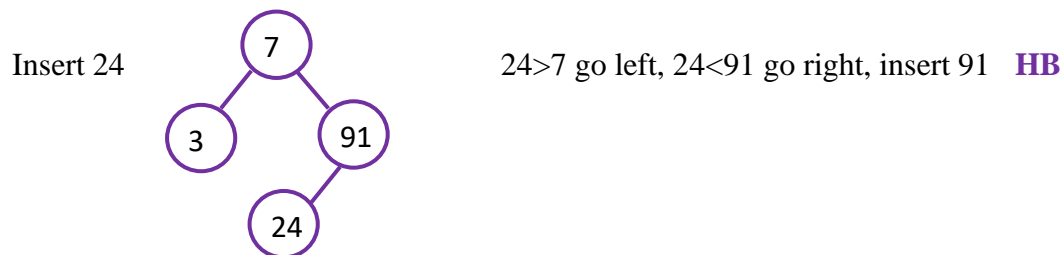
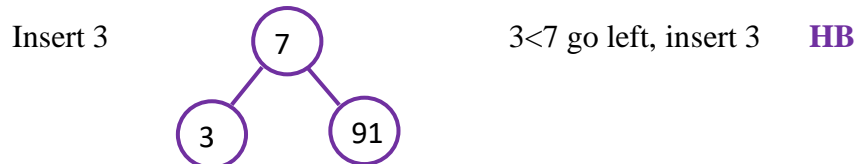
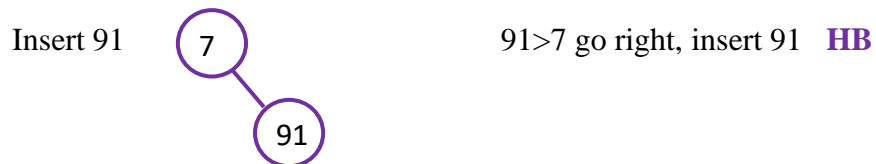
Description: This file examines the insertion and deletion operations on AVL, 2-3, 2-3-4 Trees.

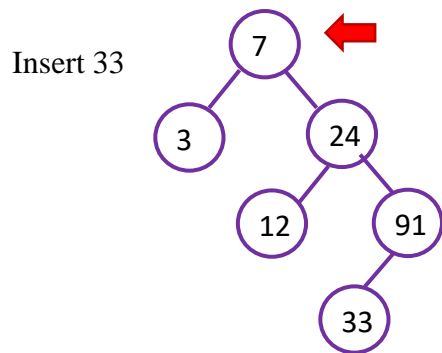
Q: insert 7, 91, 3, 24, 12, 33, 45, 61, 57

delete 3,61,45

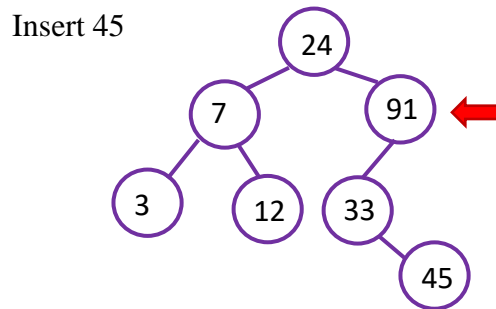
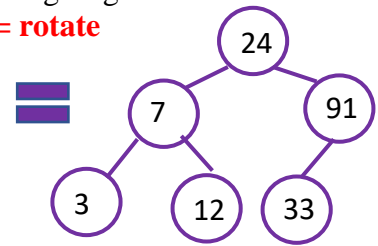
AVL TREE INSERTION

(HB: height balanced, HNB: height not balanced)

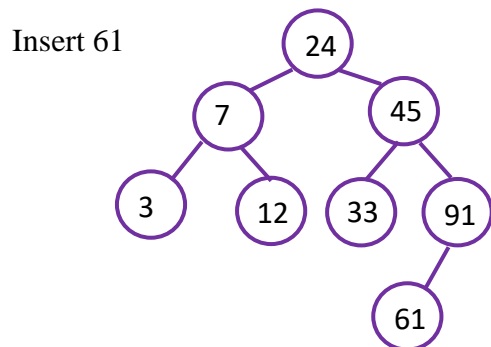
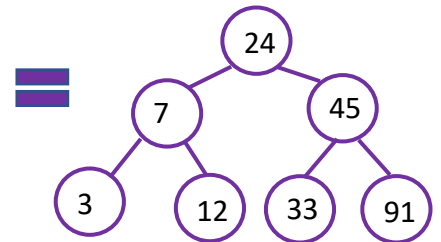




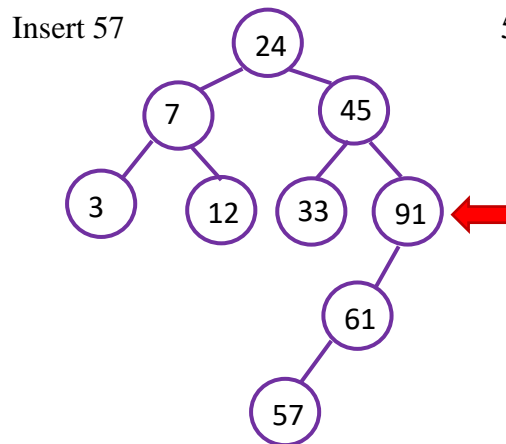
33>7 go right, 33<91 go left, 33>24 go right
33<91 go left, Insert 33 **HNB = rotate**



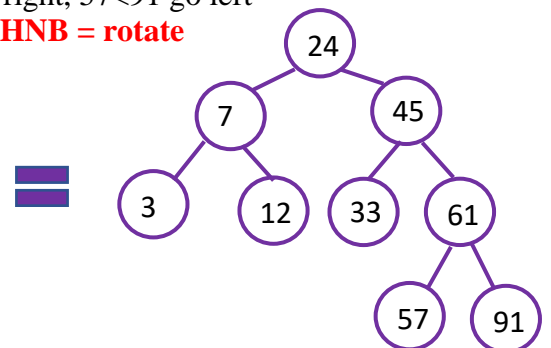
45>24 go right, 45<91 go left, 45>33 go right
Insert 45 **HNB = rotate**



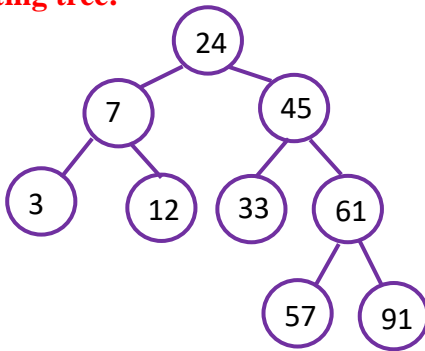
61>24 go right, 61>45 go right, 61<91 go left
Insert 61 **HB**



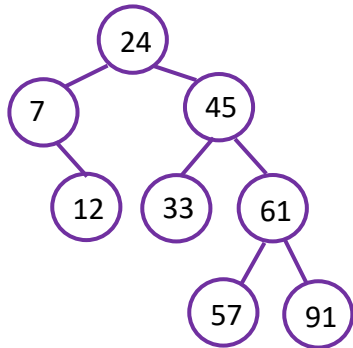
57>24 go right, 57>45 go right, 57<91 go left
57<61 go left, Insert 61 **HNB = rotate**



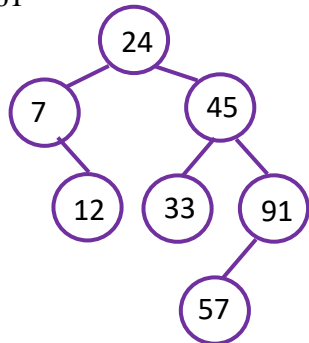
Delete 3,61,45 from this resulting tree:



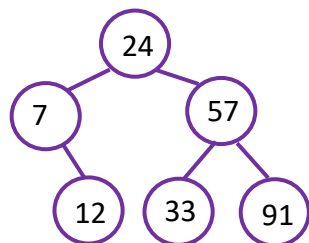
After deleting 3



After deleting 61



After deleting 45



2-3 TREE INSERTION AND DELETION

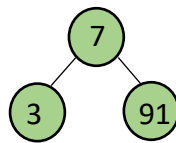
Insert 7



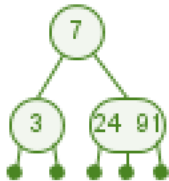
Insert 91



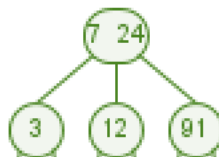
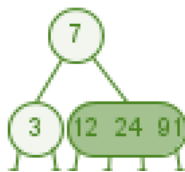
Insert 3



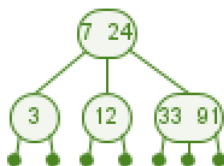
Insert 24



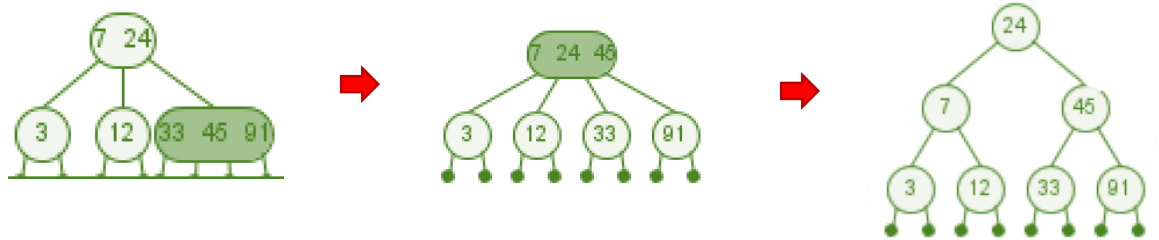
Insert 12



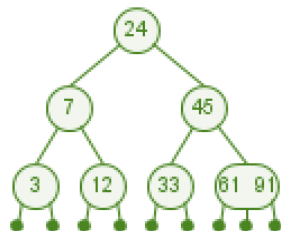
Insert 33



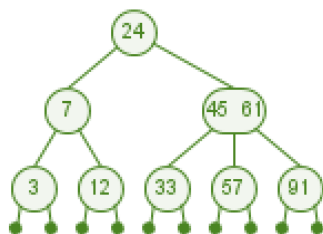
Insert 45



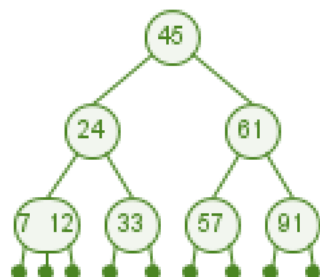
Insert 61



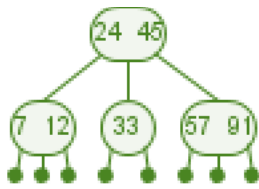
Insert 57



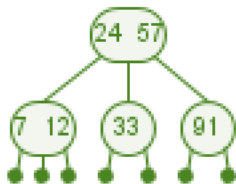
After deleting 3 :



After deleting 61:



After deleting 45:



2-3-4 TREE INSERTION AND DELETION

Insert 7



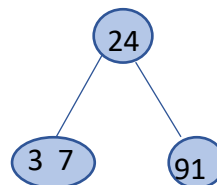
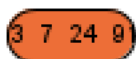
Insert 91



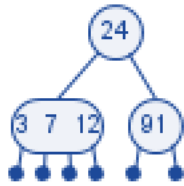
Insert 3



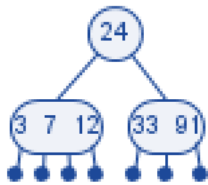
Insert 24



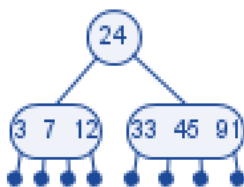
Insert 12



Insert 33



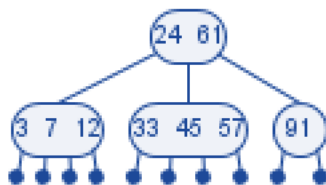
Insert 45



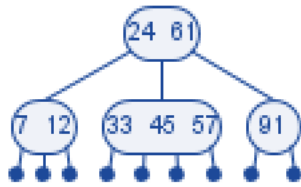
Insert 61



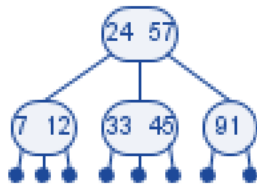
Insert 57



After deleting 3:



After deleting 61:



After deleting 45:

