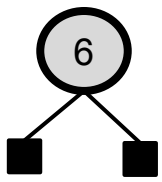
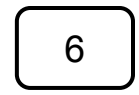
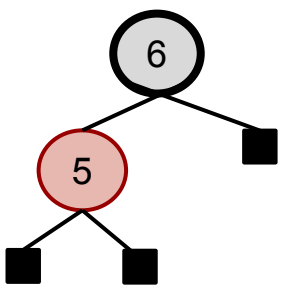
Solutions: Class 10/09, Balanced Trees

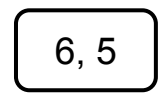


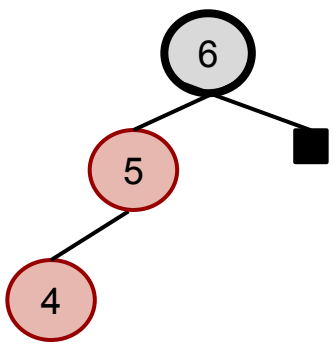
Insert 6:
← (a) RBT after insert
(b) **no** property is violated
(c) **no** remedy needed
(d) RBT after fixup is the same.
(e) (2,4): →



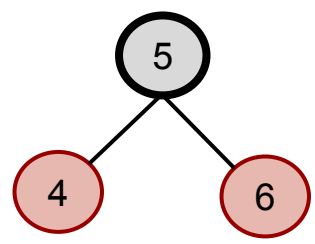


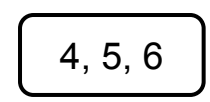
Insert 5:
← (a) RBT after insert
(b) **no** property violated
(c) **no** remedy needed
(d) RBT after fixup is the same.
(e) (2,4): →



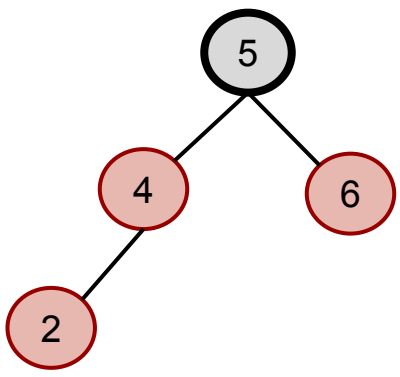


Insert 4:
← (a) RBT after insert
(b) **double red = incorrect representation**
(c) **black uncle** (sibling of red parent): **restructure**
(d,e) RBT and (2,4): →



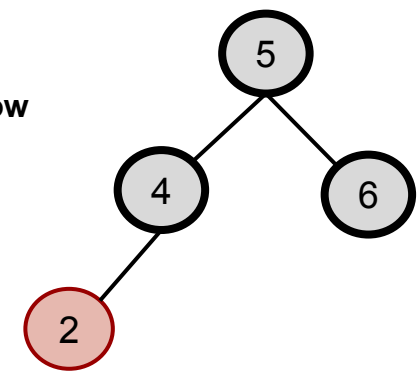


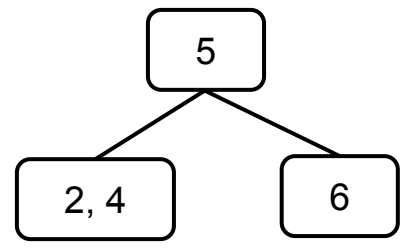
(You may leave out the black leaf nodes in the remainder. Show them only when they are the “uncle”)

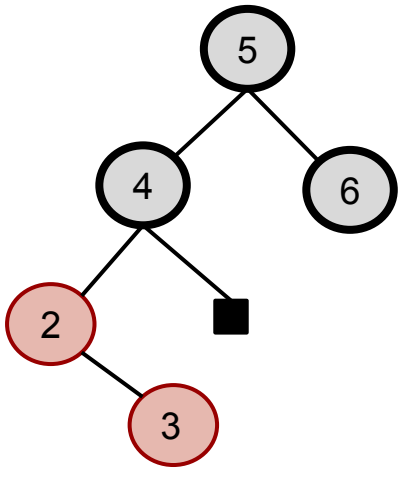


Insert 2:
← (a) RBT after insert
(b) **double red = overflow**
(c) **red uncle: recolor**
(d,e) RBT and (2,4): →

Note: 5 stays black because it is the root!







Insert 3:
← (a) RBT after insert
(b) **double red = incorrect representation**
(c) **black uncle: restructure**
(d,e) RBT and (2,4): →