CSC 212 Extra Example - AVL and B+ Tree

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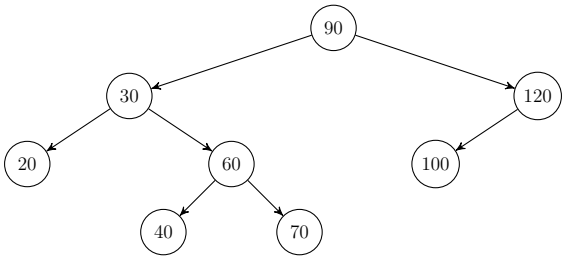
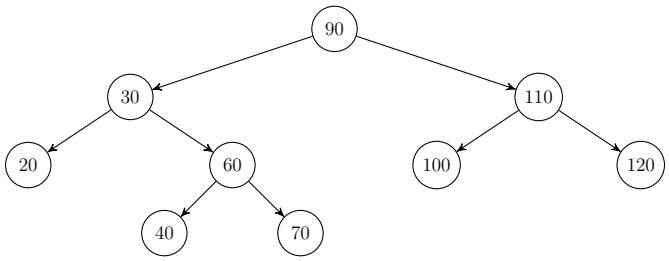
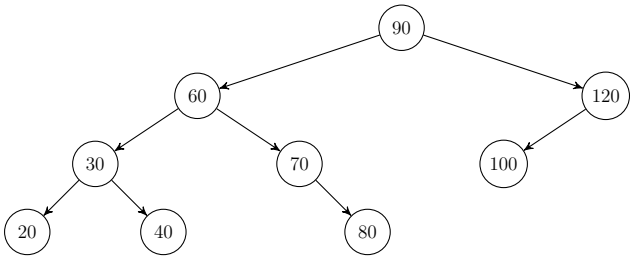
Question 1

Perform the following operations on this AVL tree: **Insert 110**, **Insert 80**, **Delete 20**, **Delete 60**, **Delete 120**. Mention the rotation type: none, single, or double. **Each operation is independent, and must be performed on the original tree. Convention:** When necessary, the key must be replaced by the smallest key in the right subtree.

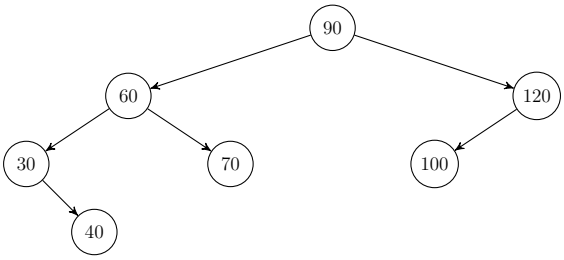




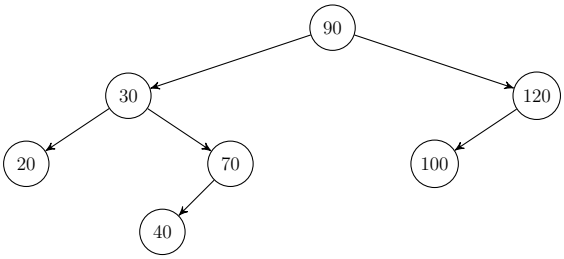
Insert 110: Double



Insert 80: Single

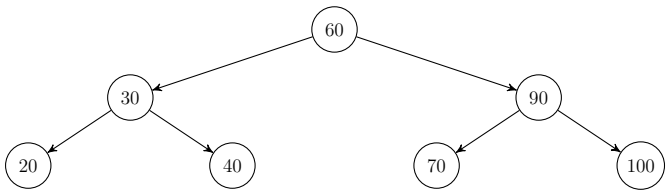


Delete 20



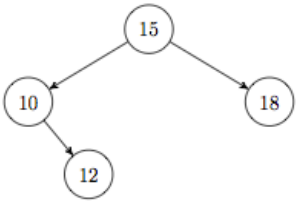
Delete 60: None

Delete 120: Double

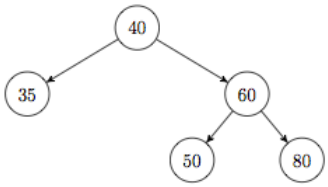


Question 2

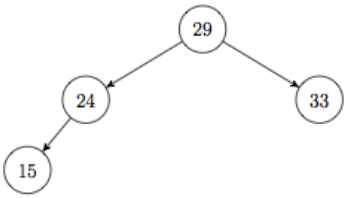
Draw the resulting AVL trees after the following operations:



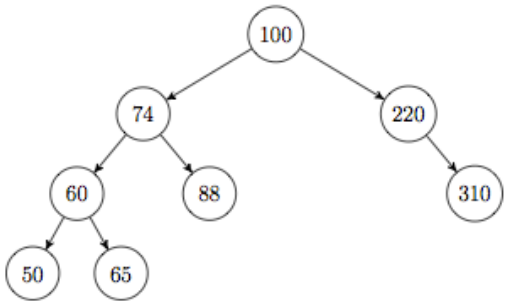
Insert 11



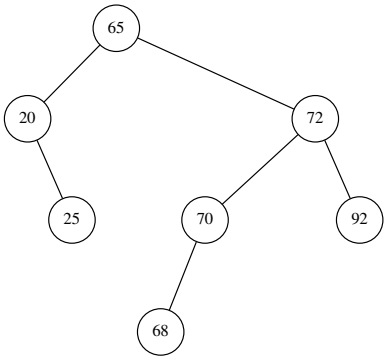
Insert 85



Insert 25

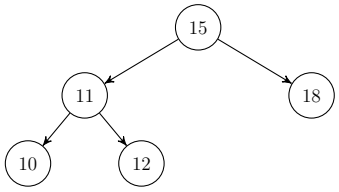


Delete 220

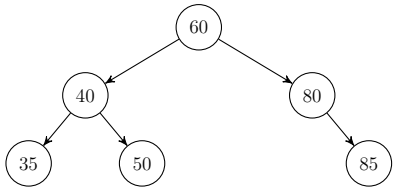


Delete 20

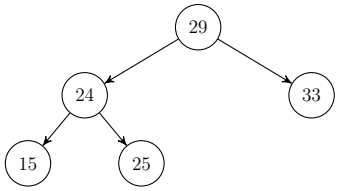
Insert 11



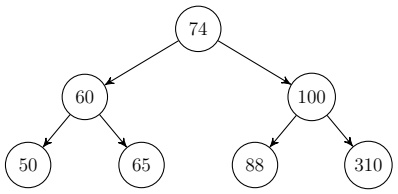
Insert 85



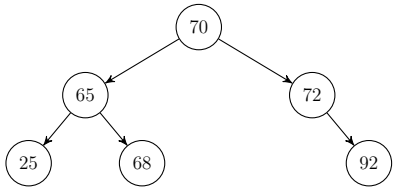
Insert 25



Delete 220

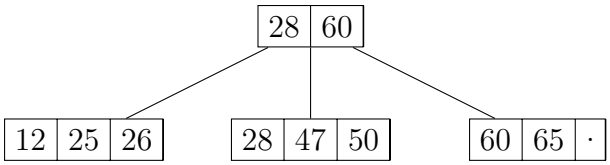


Delete 20



Question 3

Perform the following operations on this B+ Tree: **Insert 30**, **Insert 27**, **Insert 63**, **Delete 28**, **Delete 65**. Each operation is independent, and must be performed on the original tree.



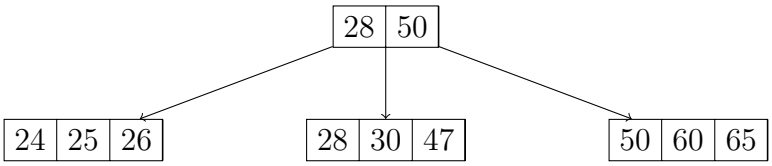


Figure 1: Insert 30 (transfer-update)

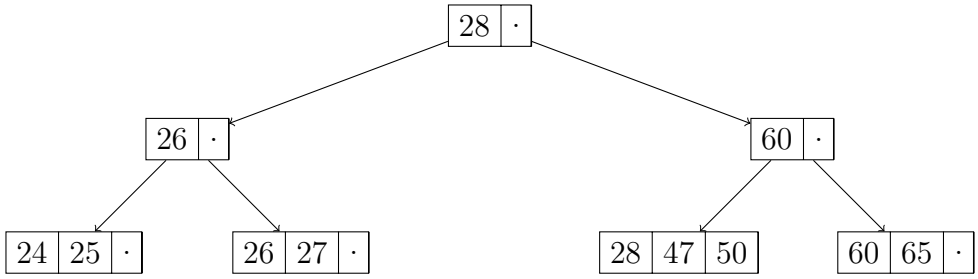


Figure 2: Insert 27 (split-split)

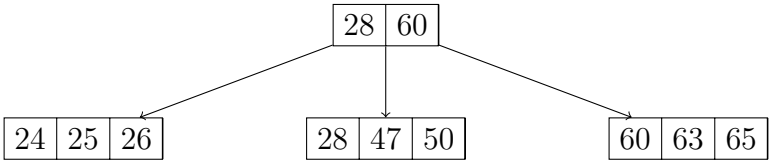


Figure 3: Insert 63 (normal)

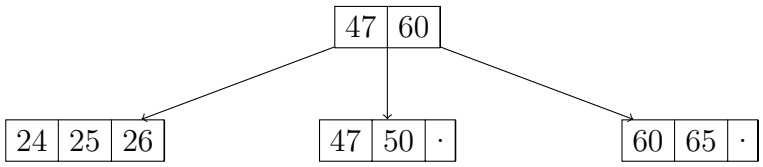


Figure 4: Delete 28 (delete-update)

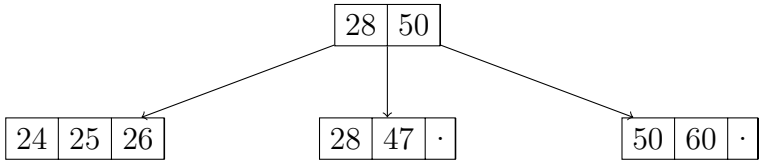
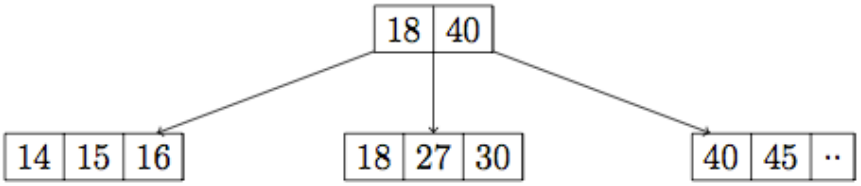


Figure 5: Delete 65 (borrow-update)

Question 4

Using the following B+ Tree (m = 3), perform the following operations: Insert 13, Insert 32, Insert 50, Insert 41, Insert 25 **show the resulting tree after each operation**



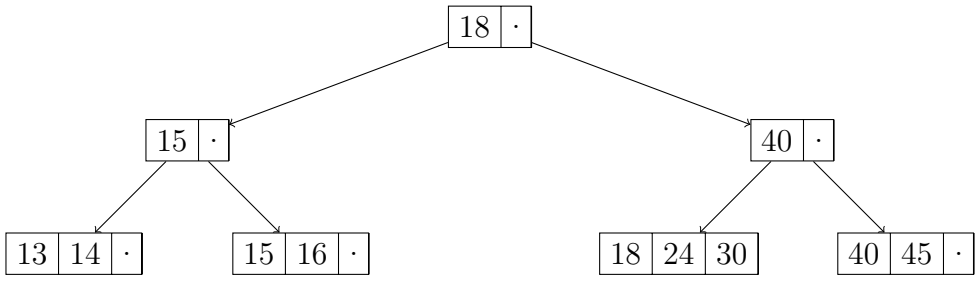


Figure 6: Insert 13

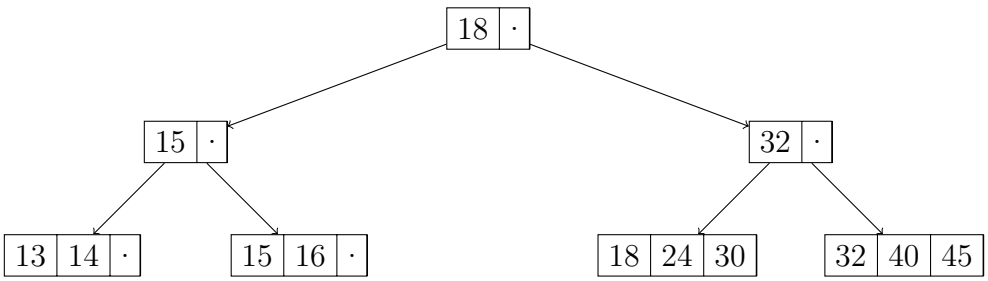


Figure 7: Insert 32

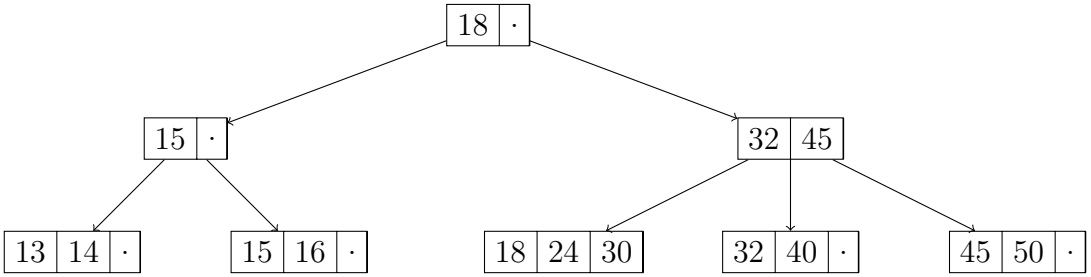


Figure 8: Insert 50

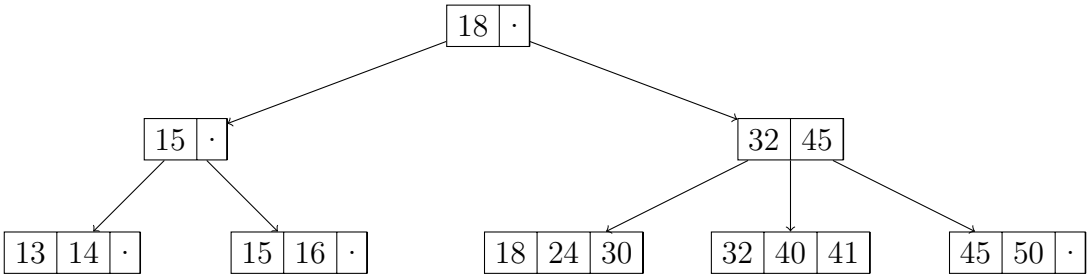


Figure 9: Insert 41

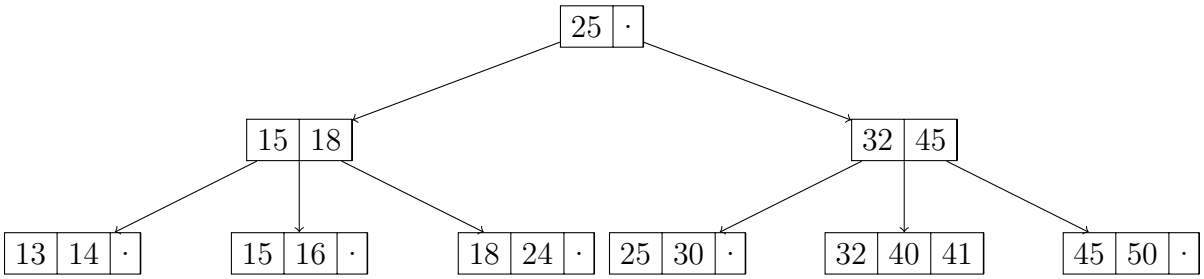


Figure 10: Insert 25 -split-transfer-update

Question 5

Using the following B+ Tree (m = 3), perform the following operations: Delete 45, Delete 15, Delete 30 **show the resulting tree after each operation**

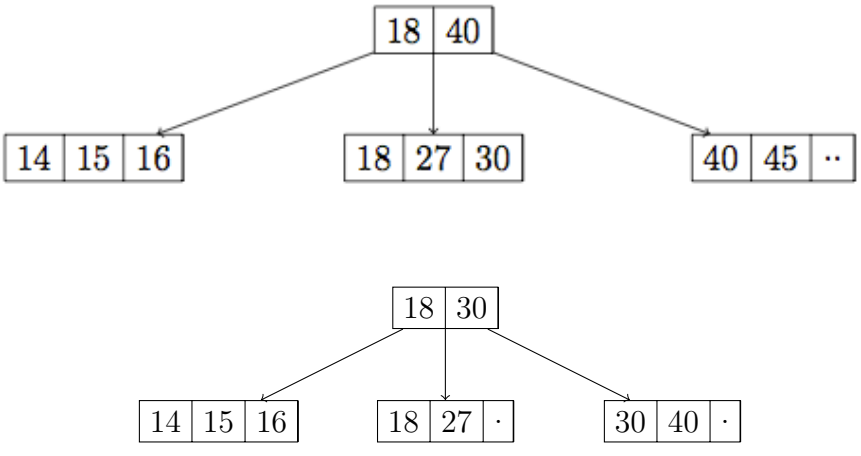


Figure 11: Delete 45

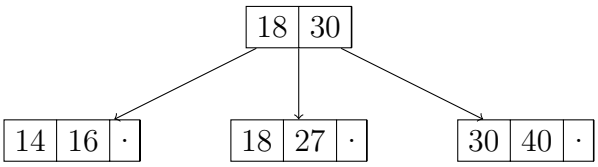


Figure 12: Delete 15

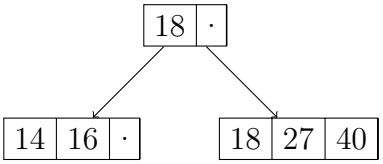


Figure 13: Delete 30