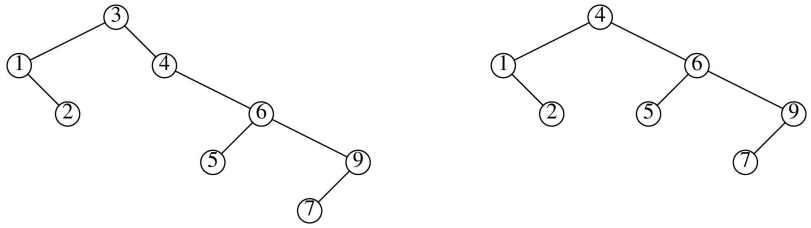
CS 152h: Data Structures Homework #5

AVL AND B TREES

4.9 (a) Show the result of inserting $3, 1, 4, 6, 9, 2, 5, 7$ into an initially empty binary search tree.

(b) Show the result of deleting the root.



Ans:

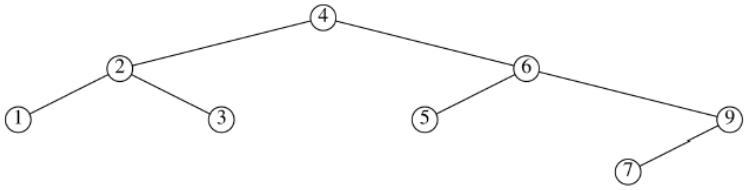
4.18 (a) Give a precise expression for the minimum number of nodes in an AVL tree of height h.

(b) What is the minimum number of nodes in an AVL tree of height 15?

Ans: (a) $N(0) = 1, N(1) = 2, N(h) = N(h-1) + N(h-2) + 1$.

(b) The heights are one less than the Fibonacci numbers.

4.19 Show the result of inserting 2, 1, 4, 5, 9, 3, 6, 7 into an initially empty AVL tree.



Ans:

4.25 (a) How many bits are required per node to store the height of a node in a N-node AVL tree?

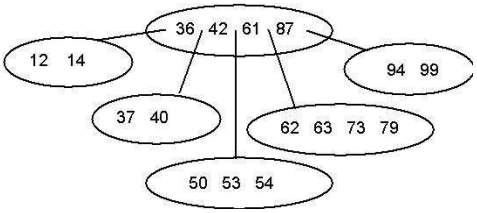
(b) What is the smallest AVL tree that overflows an 8-bit height counter?

Ans: (a) $O(\log \log N)$.

(b) The minimum AVL tree of height 127 (8-byte ints range from -128 to 127). This is a huge tree.

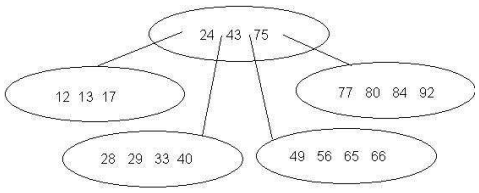
B-tree Starting with the following B-tree of order 5, perform the indicated operations and show the result after the following operations in sequence, and be sure to redraw the tree after a node merge.

Delete 50, Delete 36, Delete 73, Delete 99, Delete 40.



B-tree Starting with the following B-tree of order 5, perform the indicated operations and show the result after each operation, and be sure to redraw the tree after a node split. When a node overflows, split it immediately.

Insert 62, Insert 54, Insert 99, Insert 61, Insert 20.


24 43 75
12 13 17
77 80 84 92
28 29 33 40
49 56 65 66