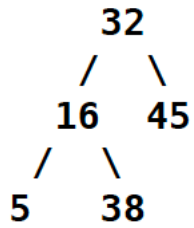
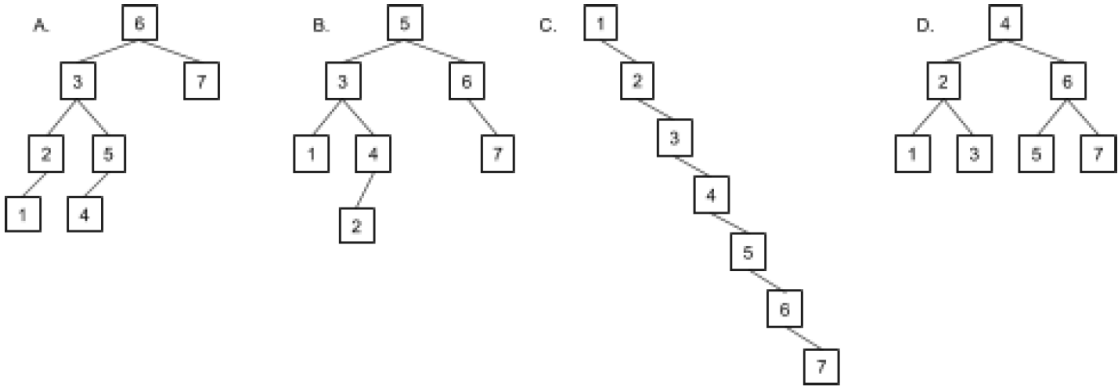
Advanced Algorithms and Data Structures
Trees
Exercises
Prepared by LY Rottana

1. Is this tree a valid Binary Search Tree? (BTS) Why?



2. Which of the following is not a valid binary search tree? Of the valid ones, which is fastest to search?



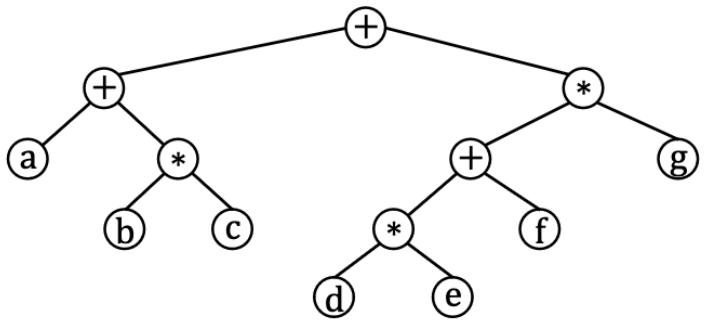
3. Suppose we have integer values between 1 and 1000 in a BST and search for 363. Which of the following cannot be the sequence of keys examined?
    a. 2, 252, 401, 398, 330, 363
    b. 399, 387, 219, 266, 382, 381, 278, 363
    c. 3, 923, 220, 911, 244, 898, 258, 362, 363
    d. 4, 924, 278, 347, 621, 299, 392, 358, 363
    e. 5, 925, 202, 910, 245, 363

4. Draw the binary search tree that results from inserting the following values into an initially empty binary search tree in the following order: 50, 27, 16, 88, 34, 65, 52, 77, 93, 4, 12, 29, 44, 92.
    a. List the values of the tree nodes in the order the nodes are visited in a preorder, inorder, and postorder traversal of the tree.
    b. If a search was conducted for the value 37 in the final binary search tree, which nodes would get visited? (List them in the order they get visited.)

5. Use the Binary Search Tree insertion algorithm to insert the keys 1, 2, 3, 4, 5, 6, 7 into an initially empty BST in that order.
    a. What is the height of the resulting tree?
    b. What is the (exact) average number of nodes that must be visited to find a value that is in this tree assuming that all values 1-7 are equally likely to be searched for?
    c. In general, if we add the numbers 1 through n to a binary tree (in order), what is the average number of nodes that will be accessed during the find operation in the resulting tree?

6. Draw the binary search tree with the smallest possible height containing the keys 1, 2, 3, 4, 5, 6, 7.
    a. What is the height of the resulting tree?
    b. What is the (exact) average number of nodes that must be visited to find a value that is in this tree assuming that all values 1-7 are equally likely to be searched for?
    c. In general, if we add the numbers 1 through n to a binary tree (in order), what is the average number of nodes that will be accessed during the find operation in the resulting tree?
    d. List the values of the tree nodes in the order the nodes are visited in a preorder, inorder, and postorder traversal of the tree.

7. List the values of the tree nodes in the order the nodes are visited in a preorder, inorder, and postorder traversal of the tree.



8. Consider the algebraic expression E = $(5x+z)\ (3a-b)^2$, Draw the expression tree corresponding to E.