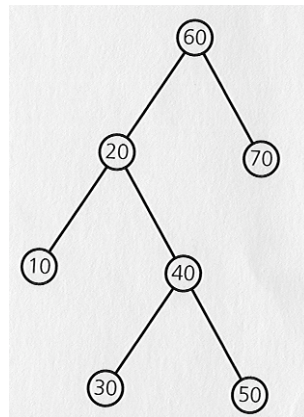


Homework 3 – Due Tuesday February 22 at 8:00 pm 95 points possible

You must turn in your homework in ps or pdf format

Be sure to include the names of your partners and how long you worked on the homework together. Remember that you must work with at least 2 other people to form a group of three and you must work for at least 2 hours together (minimum of 1 hour sessions).



- (10 pts) Starting with an empty binary search tree, in what order should you insert items to get the binary search tree shown above?
- (10 pts) Trace the treesort algorithm as it sorts the following array into ascending order: 20 80 40 25 60 30
- (10 pts) Consider the binary search tree in question 1.
 - What tree results after you insert the nodes 80, 65, 75, 45, 35, and 25 in that order?
 - After inserting the nodes mentioned in part a, what tree results when you delete the nodes 50 and 20
- (10 pts) Show that the maximum number of nodes in a binary search tree of height h is $(2^{h+1} - 1)$. A binary tree of height h with the maximum number of nodes is called a full binary tree. You may just show me a picture to show this property, however, remember that 1 example does not prove anything. Give a base case and sufficiently build upon that.
- (10 pts) A full node in a binary tree is a node with two children. Prove that the number of full nodes plus one is equal to the number of leaves in a full binary tree. You may just

show me a picture to show this property, however, remember that 1 example does not prove anything. Give a base case and sufficiently build upon that.

6. (10 pts) Draw an expression tree corresponding to the following expression:

$$(a + b) / (c - d * e) + f + g * h / i$$

7. (5 pts) Suppose that you traverse the binary search tree in question 1 and write the data item in each node visited to a file. You plan to read this file later and create a new binary search tree by using the ADT search tree operation `searchTreeInsert`. In creating the file, in what order should you traverse the tree so that the new tree will have exactly the same shape and nodes as the original tree? What does the file look like after the original tree is traversed?

8. (10 pts) Enqueue the following numbers in the given order into a Min Heap. Show the heap after each enqueue: 100, 90, 65, 55, 1, 7, 35, and 2

9. (10 pts) Perform 8 dequeue operations on the final heap from question 8. Show the heap after each dequeue.

10. (10 pts) Trace the action of `heapSort` on an array containing the items 5, 1, 2, 8, 6, 10, 3, 9, 4, 7 in that order. You must show the heap at each pass (you may show the heap as a tree structure). Use the linear time algorithm to build your heap.