

CS 240 Program 2 (and Lab 6)

For Lab 6 and Program 2, you will work in pairs. Yes, everyone must work with a partner for this assignment.

Lab 6

For Lab 6, implement a templated Binary Search Tree and to measure the runtime of your implementation. Your BST class should support the following public member functions, with the usual definitions:

- `bool insert(const T &);`
- `bool remove(const T &);`
- `bool find(const T &) const;`
- `void display() const; // inorder display`

Your code should reject duplicate insertions. Design a set of tests to see whether your implementation can show the difference between runtime complexity of balanced trees vs. unbalanced trees, for different problem sizes. To be very clear, *do not* implement a balanced binary tree! Recall and exploit the fact that insertion order influences the shape and characteristics of the tree.

Turn in your code and a 1 page “report”, including a graph, to report your findings. Your report should concisely (a) state the problem you set out to solve, (b) describe the tests you ran, and (c) draw conclusions.

Program 2

For Program 2, you will implement Ternary Search Tree, which is a simple extension of a Binary Search Tree, with the following differences:

- Each node stores 0, 1, or 2 elements.
- Each node is the parent of 0, 1, or 2 subtrees (left, center, and right).
- Nodes in the left subtree are less than the 1st stored element, nodes in the center subtree fall between the node’s two stored elements, and nodes in the right subtree are greater than the two stored elements.

Your code should implement the same exact interface as the Binary Search Tree. Design a set of tests to see whether the runtime of BST and TST implementations differ significantly for large numbers of stored nodes. $\log_2 N$ should grow faster than $\log_3 N$, right? Your tests should try to uncover “how big” a difference that makes, in an implementation.

Turn in your code, comprehensive test programs that demonstrate that your BST and TST implementations work properly, and a 1 page report that concisely (a) states the problem that you set out to solve for Program 2, (b) describes the tests that you ran, and (c) draws conclusions about the runtime difference between your BST and TST implementations.