

Lab 9 Report:

By: Sam Graler and Randy Hucker (Group 25)

Instructions for Running / Compiling:

.cpp files for all Tasks are located in the submitted visual studio project. Open / run the visual studio project as normal. MobyDick.txt is in the correct directory, but if any other text files will be checked ensure they are placed in the project folder.

Work was divided evenly between each group member (50% for Sam and 50% for Randy)

Write a Lab Report that includes the following information:

- a. A description of the objectives/concepts explored in this assignment including why you think they are important to this course and a career in CS and/or Engineering.
 - Over lab 9 we took a deep dive into balancing binary trees. We also touched operator overloading and template classes again, but the priority was balancing trees. Balancing trees is important as balancing the tree makes for better search times $O(\log(n))$ as opposed to $O(n)$. We discovered that as we increase the value of n , the disparity between the two approaches increases - the unbalanced way creates a lopsided tree which makes searching far less efficient (also affects insert and remove), and the balanced way creates a BST with an efficient, ordered (ascending or descending order) presentation where the search function is consistently efficient.
- b. Discuss in your lab report the performance difference you would expect without vs. with balancing. This includes both the insert/remove performance and finding performance.
 - The balancing function makes searching far more efficient, but it increases the complexity of the insert and remove functions because the tree must be balanced. Obviously, the search function's performance would be less consistent without balancing. When the tree is not balanced, we would have to search through many levels to find our node in the worst case, however, with balancing, we will never need to traverse more than $\log_2(n)$ levels to arrive at our desired key value because we have confidence in our balancing functions and our ability to insert/remove without destroying the integrity of the tree. Without balancing a tree, you may also need to go down a massive branch to insert or remove nodes, which over time would decrease efficiency.