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301586491 Assignment 4

The search trees being compared in this report are the Binary Search Tree, the Red-Black Tree, and the Treap.

The 2 keys sets being inserted are n1 and n2, where n1 is all the numbers from 1 to 20000 with 3 added to each element, and n2 is all the numbers from 1 to 10000 multiplied by 2.

In this assignment, I will be comparing the time taken by the 3 previously mentioned search trees to insert n1 and n2 into 2 separate search trees, and the time it takes to count all the even numbers in each data structure.

Trial #1

Data Structure	Time Taken (ms)
Binary Search Tree Insertion	2165
Binary Search Tree Traversal	0
Red-Black Tree Insertion	14
Red-Black Tree Traversal	2
Treap Insertion	13
Treap Traversal	0

Trial #2

Data Structure	Time Taken (ms)
Binary Search Tree Insertion	2154
Binary Search Tree Traversal	1
Red-Black Tree Insertion	11
Red-Black Tree Traversal	1
Treap Insertion	12
Treap Traversal	1

Trial #3

Data Structure	Time Taken (ms)
Binary Search Tree Insertion	2208
Binary Search Tree Traversal	2
Red-Black Tree Insertion	15
Red-Black Tree Traversal	3
Treap Insertion	8
Treap Traversal	1

Average

Data Structure	Time Taken (ms)
Binary Search Tree Insertion	$2{,}175.\overline{6}$
Binary Search Tree Traversal	1
Red-Black Tree Insertion	$13.\overline{3}$
Red-Black Tree Traversal	2
Treap Insertion	11
Treap Traversal	$.\overline{6}$

For inserting, it is clear the Binary Search Trees perform the worst, followed by Treaps then Red-Black Trees. BST performs the worst due to the data inserted, as the BST instead of being short and bushy is very tall and skinny such that height is relative to the number of nodes since the values inserted are always increasing, so everything is inserted in the right. This significantly increasing time needed to go through it. To improve this, the number should have been randomized in order to give BST a fair chance. However, traversal is clearly very fast due to the same tree structure. It only goes one way, so it quickly moves through the list and checks if it is even. Treaps and RBT insertion's time are relatively similar since they both share O(logn) insertion time. All the trees share relatively similar traversal times,