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COSC 320 - HOMEWORK 06

Dr. Spickler

4/4/24

In this homework, we compared the difference in speed of inserting using the DSW and AVL algorithms. The most significant differences of speed are revealed behind a fundamental property after timing a grid of various values for the number of integers to insert, and the maximum random value from zero. This fundamental property that dictates the difference in speed is the frequency of repeated values. For example, a test run of 5 million elements with a value ceiling of 5 hundred-thousand, is completed in 1.9 seconds using the AVL algorithm while the DSW took over 27 seconds. Another example, a test run of 5 million elements with a value ceiling of 50 million, is completed in 7.1 seconds using the AVL algorithm while the DSW took under 6 seconds. It is apparent, with these two data points, that the repetition in nodes is handled differently, and much more efficiently, by the AVL algorithm. This is revealed in code by AVL stacking nodes with identical values using a count variable on each node. This count value in turn decreases the total number of nodes, and in turn the height.

Given this analysis, the DSW algorithm inserts at an exponentially slower rate compared to the AVL algorithm under an increase in inserted nodes and/or likelihood of duplicate nodes.

The lines of best fit for each set of data can be found below, on the second page.
All gathered data is on 10 tests of insertions incremented from 500,000 to 5,000,000 times.

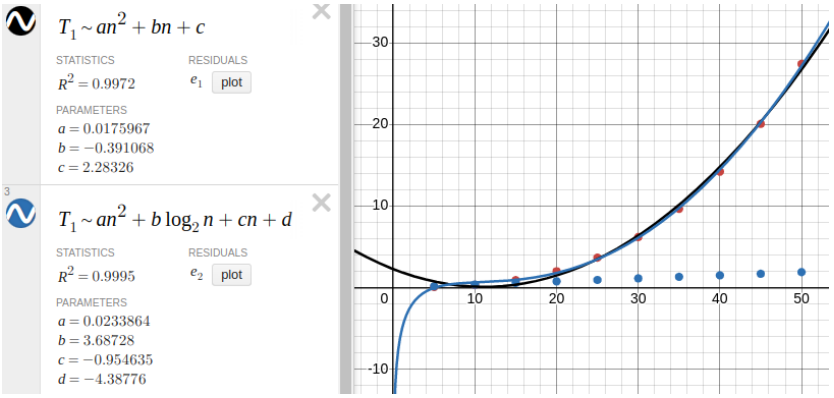
Red Data Points: DSW Algorithm Blue Data Points: AVL Algorithm

Y-Axis: Time (Seconds) X-Axis: Insert Calls (Hundred Thousands)

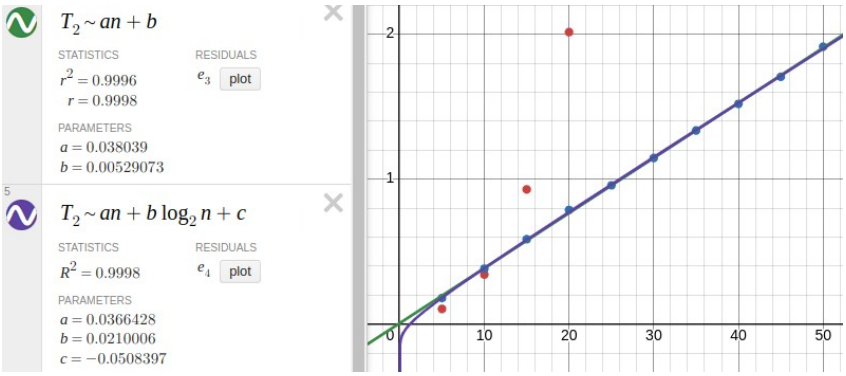
3 Rand_Max sections of data: 0-500,000 , 0-5,000,000 , 0-50,000,000

0 – 500,000 (100% to 10% of number of insert calls)

DSW:

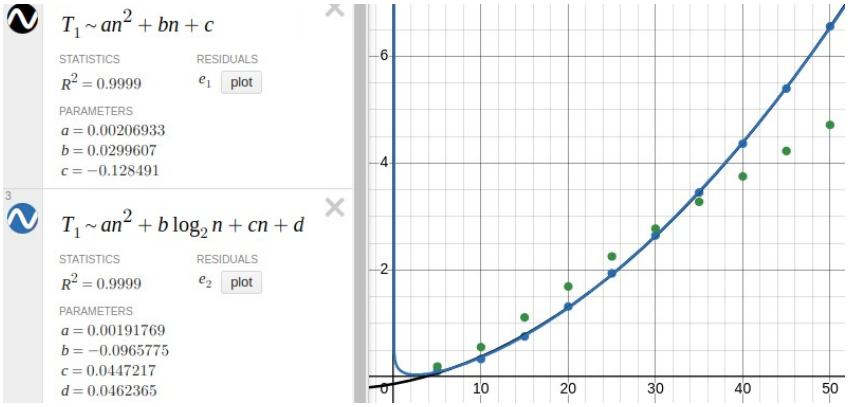


AVL:

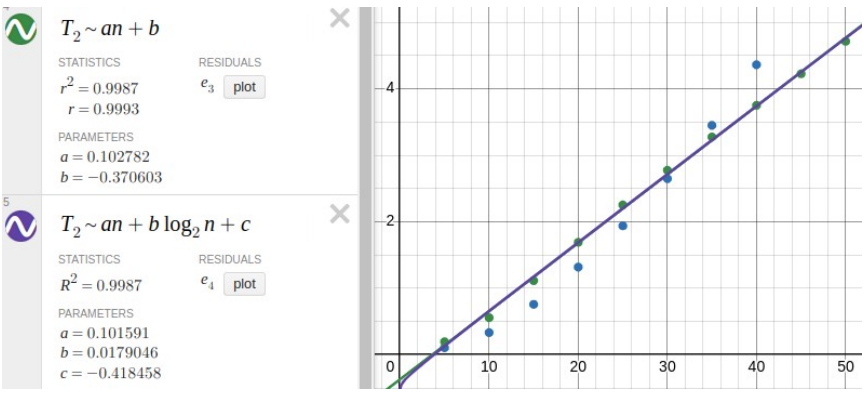


0 – 5,000,000 (1,000% to 100% of number of insert calls)

DSW:

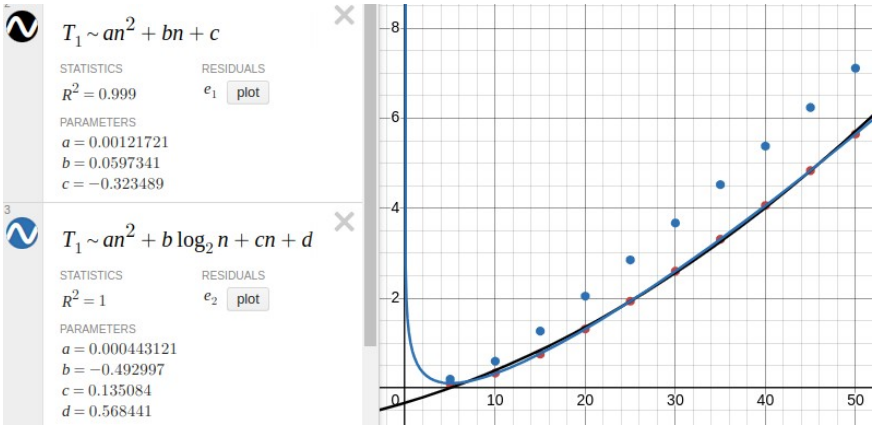


AVL:

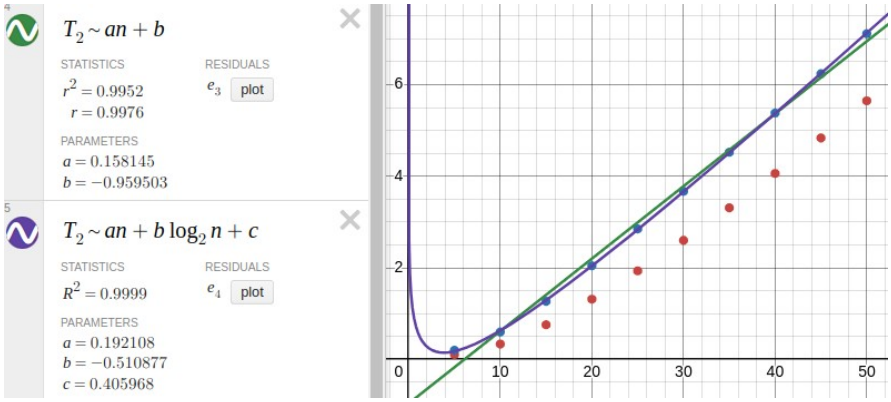


0 – 50,000,000 (10,000% - 1,000% of number of insert calls)

DSW:



AVL:



After analysis of the lines of best fit, it seems that the apparent complexity of inserting for the AVL algorithm is O(n) and DSW is O(n^2). The function best representing AVL was (an+blgn+c) for all rand_max values and insert call sizes. The function best representing DSW was (an^2+blgn+cn+d) for all rand_max values and insert call sizes. The R2 values for DSW remained all above 0.9972. The R2 values for AVL remained all above 0.9987. Considering the eventual respective improvement of DSW to AVL, my final analytical point of this research, in the timing complexity of these two methods of inserting nodes, is that considering the greater complexity of the DSW insertion, with a large enough insertion count in regards to the rand_max value, the AVL algorithm will always eventually outperform DSW.