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Lab #4 Report

The organization of the experimental profiling was to use “double” variable types to keep track of the small values to keep track of the timing for each step of the experiment, including the averages. The three tables used in the experiment were an Open Hash Table with Chaining, a closed Hash Table with Double Hashing, and a closed hash table with Quadratic Probing. Each table had the size 100,003. First, the data was generated into two separate arrays, one to hold the values of the input values into the hash tables, and one to hold the values to search the hash tables for. The input array was either 10,000 values, 20,000 values, 30,000 values, 40,001 values, or 50,001 values. The random values generated had the range between 1 and 500,015. The size of the array of values to search the tables with was 1000 values and they each had a range between 1 and 500,015. Secondly, each table was then timed to see how long it would take to insert each value of the input array based on their hashing equation. Then, each table was timed to see how long it would take to find or not find a value from the search array. Finally, this was then repeated four more times with a different seed to generate a new input value array and search value array. The average times of each trial on each table were then calculated and reported to the console. This overall process was repeated four more times, increasing the size of the input array.

Performance Tables Results:

Open Hash Table	10,000 Values	20,000 Values	30,000 Values	40,001 Values	50,001 Values
Average Build (seconds)	4.54e ⁻⁴	8.48e ⁻⁴	0.0013	0.0018	0.0023
Average Value Found (seconds)	7.8e ⁻⁶	1.16e ⁻⁵	1.7e ⁻⁵	2.46e ⁻⁵	2.32e ⁻⁵
Average Value Not Found (seconds)	2.62e ⁻⁴	2.55e ⁻⁴	2.62e ⁻⁴	2.5e ⁻⁴	2.51e ⁻⁴

Quadratic Probing	10,000 Values	20,000 Values	30,000 Values	40,001 Values	50,001 Values
Average Build (seconds)	1.95e ⁻⁴	4.08e ⁻⁴	6.78e ⁻⁴	9.29e ⁻⁴	0.0013
Average Value Found (seconds)	0.00203	0.00365	0.00448	0.00653	0.00712
Average Value Not Found (seconds)	0.165	0.163	0.16	0.156	0.154

Double Hashing	10,000 Values	20,000 Values	30,000 Values	40,001 Values	50,001 Values
Average Build (seconds)	1.98e ⁻⁴	4.04e ⁻⁴	6.67e ⁻⁴	0.00101	0.00141
Average Value Found (seconds)	0.00203	0.00365	0.0045	0.0066	0.0071
Average Value Not Found (seconds)	0.165	0.162	0.16	0.156	0.154

The Open Hash Table with Chaining ended up being the slowest to build compared to the other two tables as the size of input values increased. However, this was the only category that it displayed the slowest average operation time. Quadratic Probing had the average fastest build time as the size of input values increased, and Double Hashing was about nearly as fast. The average times for the Find operation on the Quadratic Probing and Double Hashing were almost identical, although much slower than the Open Hash Table.

In conclusion, the Quadratic Table and Double Hash tables were much faster at building compared to the Open Hash Table while the input size was less than 40,001. As the size of values increased past this value, the average build times for all three tables were relatively the same. However, Open Hash Table had the superior average search time for 1,000 values compared to the other two tables, which were much slower. The average search time for Quadratic Probing and Double hashing did slightly decrease as the input size grew, possibly due to clustering.