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Data Structures-Project 7

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Time Analysis of Insertion and Find in Hash Tables using Linear Probing and Chaining

Hash\_table\_1 utilized the linear probing method while Hash\_table\_2 used the chaining method. Both hash tables were initialized with size of 50000. Next, each table was filled (using the “put” function) with 40000 values and keys (same values for each table). Afterwards, the “get” function for both hash tables were utilized. The operation time for each hash table was recorded separately. After 8 runs, these are the results:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Time (sec) | |  |  |
| Trial | Linear Probing | Chaining | Time Ratio of Linear to Chain | Time Ratio of Chain to Linear |
| 1 | 0.003809 | 0.005822 | 0.65 | 1.53 |
| 2 | 0.004624 | 0.0058 | 0.80 | 1.25 |
| 3 | 0.004192 | 0.005754 | 0.73 | 1.37 |
| 4 | 0.005629 | 0.005766 | 0.98 | 1.02 |
| 5 | 0.005661 | 0.0058 | 0.98 | 1.02 |
| 6 | 0.004021 | 0.005859 | 0.69 | 1.46 |
| 7 | 0.004851 | 0.005704 | 0.85 | 1.18 |
| 8 | 0.005763 | 0.005738 | 1.00 | 1.00 |
|  |  |  |  |  |
|  | AVERAGE | AVERAGE | AVERAGE | AVERAGE |
|  | 0.00481875 | 0.005780375 | 0.83 | 1.23 |

The Linear Probing method is almost 1.23 times faster than the Chaining method. It is faster to access a series of elements in an array than it is to follow pointers in a linked list. However, the deeper analysis deals with the load factor of the hash table. Linear Probing is usually faster than chained hashing when the load factor is less than 0.85 because of fewer collisions. However, as the load factor reaches 1, meaning that the hash table is practically full, it is best to use chained hashing.

Optional:

If a vector was used instead of linked list for the chaining method, then certain things would be optimized. Since vectors are based on array, the get function would be very fast. However, deletion and copy would be slow, since a vector must rearrange all the items, whereas a linked list can accomplish this quite quickly. Hence, there are both advantages and drawbacks.