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ANALYSIS OF ALGORITHMS

PROJECT 3

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1)

	Dictionary (Hash Table)	List
Block insertion	0.570834 seconds	0.475572 seconds
Block Lookup	0.85467 seconds	176.179 seconds

2) Insertion into dictionary and also into list take similar times. For dictionary, it takes 0.570834 seconds and for list it finished after 0.475572 seconds. Average case time complexity for insertion n elements both into dictionary and list is O(n) and those values are compatible with this complexity. However, looking an element in a hash table has O(1) complexity, for n elements O(n), whereas searching in a list for n elements takes $O(n^2)$ time. When searching an element, list starts from the beginning and traverses until it finds the element. A hash table that is used to create a dictionary does not start from somewhere or does not need to traverse the table. It needs to know only the key and the index that is generated from key by hashing. As a result of different approaches of list and hash table, lookup in dictionary lasts 0.85467 seconds while it lasts 176.179 seconds in list in the program. This huge time difference matches with the complexities.
3) The average number of collisions increases exponentially as more items are inserted to dictionary. 2 collisions have been occurred for the first 1000 elements and 357 for the first 1000 elements whereas 91229 collisions have been seen for the first 100000 elements. As more items come from the file, the empty slots in the dictionary decreases. Thus, the chance of facing a non-empty slot is increases so does collision occurrences.
4) The worst case for looking up a dictionary is that the element which is searched does not exist in the dictionary. The code will do probing until it finds the matching key for n elements. It has to look up all indexes for the key. Thus, the worst-case time complexity is $O(n^2)$. The probing part will take too much time to find the key and dominates the complexity.

***Compilation note: Please compile using g++ -std=c++11 *.cpp –O2 –o proj3**
***Author's note: When I compile my program on SSH, it is compiled perfectly. However, when it comes to lookup in list, a message appears which is saying "Killed" and the**

program stops. I could not figure out why this happens so I leave a picture of my terminal that shows the output from my computer.