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İTÜ



**BLG 335E - Analysis of
Algorithms I, Fall 2017**

CRN: 13322

Project - III

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Development Environment

Operating System:	Microsoft Windows 10
Language:	C++
Paradigm:	Object Oriented
IDE:	Dev-C++
Compilers:	G++ & MinGW
Data Structures:	Hash Table & Linked List
Libraries:	iostream, cmath, ctime, sstream, fstream

ozdemiror@ssh:~

```
[ozdemiror@ssh ~]$ g++ main.cpp bookcharacter.cpp dictionary.cpp list.cpp -o program
[ozdemiror@ssh ~]$ ./program
```

```
C:\Users\Heleluyah\Desktop\Project\HW3.exe

DICTIONARY
Insertion finished after 1.453 seconds.

Average number of collisions (first 1,000 items) | 1.475
Average number of collisions (first 10,000 items) | 14.3241
Average number of collisions (first 100,000 items) | 210.4
Average number of collisions (overall) | 390.754

Lookup finished after 1.39 seconds.

LIST
Insertion finished after 127.806 seconds.
Lookup finished after 103.36 seconds.
```

ds-set-output-dict.txt - Notepad

File Edit Format View Help

CHAPTER 2 [We have just seen that women's fate is very harsh in primitive hordes; in female animals the reproductive function is limited naturally, and when it occurs, the particular animal is more or less released from her toil; only domestic females are sometimes exploited to the point of exhaustion of their forces as reproducers and in their individual capacities by a demanding master. This was undoubtedly the case of woman at a time when the struggle against a hostile world demanded the full employment of community resources; added to the fatigues of incessant and unregulated procreation were those of hard domestic duties. Nevertheless, some historians maintain that precisely at that time, male superiority was the least marked; which means that this superiority is lived in an immediate form, not yet posited and willed; no one tries to compensate for the cruel disadvantages that handicap woman; but neither does anyone try to break her down, as will later happen in paternalistic regimes. No institution actually ratifies the inequality of the sexes; in fact, there are no institutions: no property, no inheritance, no legal system. Religion is neutral; the totems that are worshipped are asexual. It is when nomads settled the land and became farmers that institutions and law appeared. Man no longer has to limit himself to combating hostile forces; he begins to express himself concretely through the figure he imposes on the world, thinking the world and thinking himself; at that juncture, sexual differentiation is reflected in the group structure, and it takes on a particular character: in agricultural communities, woman is often vested with extraordinary prestige. This prestige is explained essentially by the new importance that children assume in a civilization based on working the land; by settling a territory, men begin to appropriate it. Property appears in collective form; it demands posterity from its owners; motherhood becomes a sacred function. Many tribes live under a communal regime: this does not mean that women belong to all the men in the community; it is no longer thought today that promiscuous marriages were ever practiced; but men and women only have a religious, social, and economic existence as a group: their individuality remains purely biological fact; marriage, whatever its form - monogamy, polygamy, polyandry - is itself nothing but a secular incident that does not create a mystical link. For the wife it is in no way a source of servitude, as she remains an integral part of her clan. The clan as a whole, gathered under the same totem, mystically shares the same mana and materially shares the common enjoyment of a territory. But in the alienation process mentioned before, the clan grasps itself in this territory in the guise of an objective and concrete figure; through the permanence of the land, the clan thus realizes itself as a unity whose identity persists throughout the passage of time. Only this existential process makes it possible to understand the identification that has survived to this day among the clan, the gens, the family, and property. In the thinking of nomadic tribes, only the moment exists; the agricultural community replaces this thinking with the concept of life rooted in the past and incorporating the future: the totem ancestor who gives his name to the clan members is venerated, and the clan takes an abiding interest in its descendants: it will survive through the land that he bequeaths to them and that they will exploit. The community conceives of its unity and wills its existence beyond the present; it sees itself in its children, it recognizes them as its own, and it accomplishes itself through them. But many primitives are unaware of the father's role in the procreation of children, who are thought to be the reincarnation of ancestral larvae floating around certain trees, certain rocks, in certain sacred places, and descending into the woman's body; in some cases, they believe she must not be a virgin if this infiltration is to take place; but other peoples believe that it also takes place through the nostrils or mouth; at any rate, defilement is secondary here, and for mystical reasons the prerogative is rarely the husband's. The mother is clearly necessary for the birth of the child; she is the one who keeps and nourishes the germ within her, and so the life of the clan is propagated in the visible world through her. This is how she finds

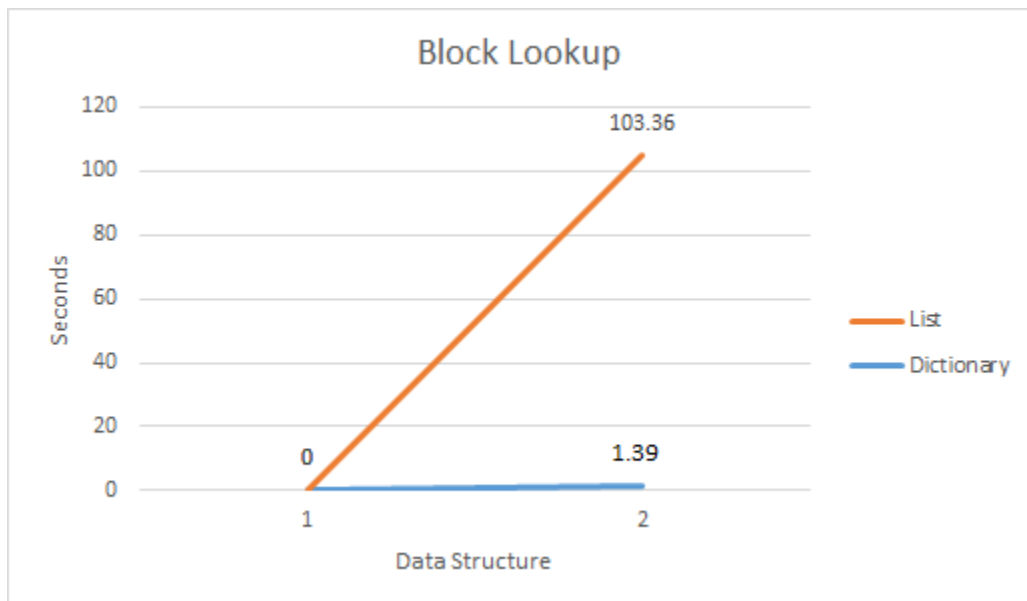
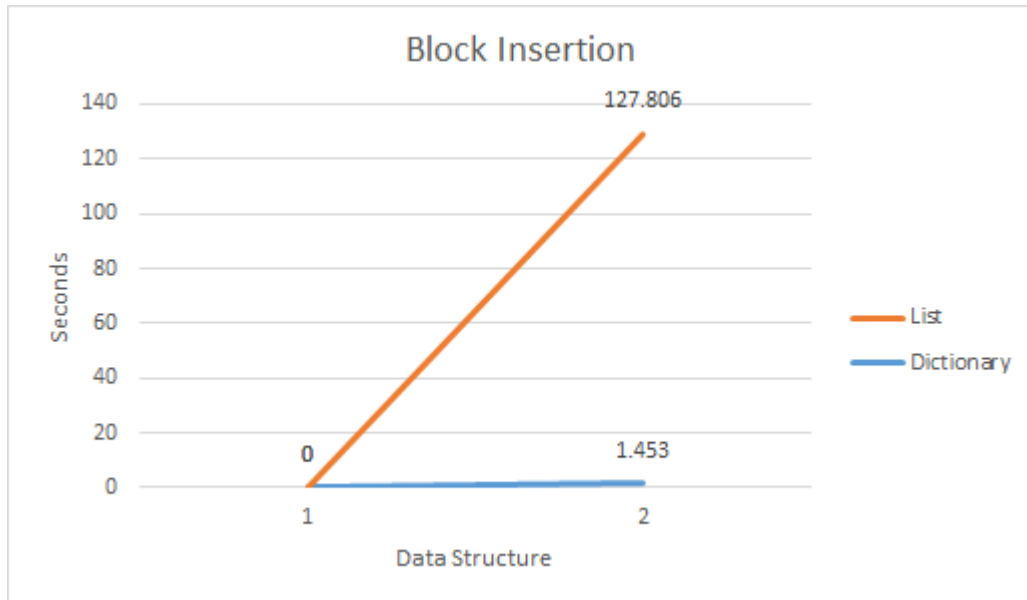
ds-set-output-list.txt - Notepad

File Edit Format View Help

CHAPTER 2 [We have just seen that women's fate is very harsh in primitive hordes; in female animals the reproductive function is limited naturally, and when it occurs, the particular animal is more or less released from her toil; only domestic females are sometimes exploited to the point of exhaustion of their forces as reproducers and in their individual capacities by a demanding master. This was undoubtedly the case of woman at a time when the struggle against a hostile world demanded the full employment of community resources; added to the fatigues of incessant and unregulated procreation were those of hard domestic duties. Nevertheless, some historians maintain that precisely at that time, male superiority was the least marked; which means that this superiority is lived in an immediate form, not yet posited and willed; no one tries to compensate for the cruel disadvantages that handicap woman; but neither does anyone try to break her down, as will later happen in paternalistic regimes. No institution actually ratifies the inequality of the sexes; in fact, there are no institutions: no property, no inheritance, no legal system. Religion is neutral; the totems that are worshipped are asexual. It is when nomads settled the land and became farmers that institutions and law appeared. Man no longer has to limit himself to combating hostile forces; he begins to express himself concretely through the figure he imposes on the world, thinking the world and thinking himself; at that juncture, sexual differentiation is reflected in the group structure, and it takes on a particular character: in agricultural communities, woman is often vested with extraordinary prestige. This prestige is explained essentially by the new importance that children assume in a civilization based on working the land; by settling a territory, men begin to appropriate it. Property appears in collective form; it demands posterity from its owners; motherhood becomes a sacred function. Many tribes live under a communal regime: this does not mean that women belong to all the men in the community; it is no longer thought today that promiscuous marriages were ever practiced; but men and women only have a religious, social, and economic existence as a group: their individuality remains purely biological fact; marriage, whatever

Questions

Q1)



Q2) Certainly, there is a huge performance difference between linked list and hash table (dictionary) implementations. Push operations in linked list always get the root pointer and then traverse nodes of list until it found NULL pointer. So, it's an expensive operation to insert new nodes. However, hash tables always compute hashes for values and then try to get the value with the help of hash or i^{th} probed hash. Hashing method provides a faster insertion and lookup algorithms for hash tables.

- Lookup complexity for linked list: $\theta(n)$
- Lookup complexity for hash table: $\theta(1)$
- Insertion complexity for linked list: $\theta(n)$ (If you give desired position it could be $\theta(1)$)
- Insertion complexity for hash table: $\theta(1)$

Results of the observed values from this project converges and justifies the complexities that are given above.

Q3) Collision in hash table means computed hash of the data has been computed before for another data. To solve this problem, algorithm has to generate a new hash. In this project, I defined a quadratic probing hash function. This probing hash function generates new hashes as long as it found a unique one. When inserted number of items increases then the remaining blank areas will decrease. Hence, this leads more number of collisions.

- Average number of collisions (first 1,000 items): 1.475
- Average number of collisions (first 10,000 items): 14.3241
- Average number of collisions (first 100,000 items): 210.4
- Average number of collisions (overall): 390.754

Number of collisions increase linearly. (1.4 \rightarrow 14.3 \rightarrow 210.4, nearly multiplied by 10).

Q4) Worst case for looking up a key in dictionary (hash table) is $O(n)$. For example, if the hashes of value always redirect lookup algorithm to its next key and if their unique keys could not be matched, hash will be regenerated until the last item when unique keys finally can be matched. This results $O(n)$ complexity. And the dominating part of this complexity will be quadratic probing function. Because, every time probing function will be run and generate new hash until the n^{th} item.