جـــامعة نـيـويـورك أبـــوظبي

NEW YORK UNIVERSITY ABU DHABI

DATA STRUCTURES

Lab Exercise: Hash Table

Download the starter code and the zipcodes.csv files from Brightspace and complete the missing methods, which include:

1. unsigned **long hashCode**(const string key) **(2 Points)**
   Write a function that generates and returns a hash code for a given key. Use one of the following hash functions discussed in the class:
   - Polynomial hash function
   - Cyclic-shift hash function

2. void **insert**(const string key, const string value) **(2 Points)**
   A function that inserts an entry (key, value pair) in the Hash Table. If the key already exists in the table, then its value must be updated. You can use one of the following collision resolution methods.
   1. Linear Probing (Refer to page #384 of the Textbook)
   2. Quadratic Probing (Refer to page #385 of the Textbook

3. void **remove**(string key) **(2 Points)**
   This method should remove an entry from the hash table. Use "lazy deletion", i.e., mark a bucket as deleted (or available for reuse) instead of removing it immediately. (Refer to pages #384 and #385 of the Textbook).

4. string **search**(const string key) **(2 Points)**
   A function that searches for a key in the Hash Table and returns its value, concatenated with the number of comparisons made to find the record (see screenshots below). The method should return the string "*Record not found!*" if the key is not present in the Hash Table.

5. **~HashTable()** **(1 Points)**
   The destructor of the class must deallocate/cleanup memory.

6. **Comments:** **(1 Point)**
   Comments are a very important part of any program. You should always write comments in your code, even if not explicitly asked.

Sample output of the program

```
================================================
Hash Table size = 19881
Total Number of Collisions = 25027
Avg. # collisions/entry = 1.3
================================================
>find Whitehouse
Zip code for Whitehouse is: 8888   (comparisons = 1)
>find Bremen
Zip code for Bremen is: 58356   (comparisons = 1)
>find Abu Dhabi
Record not found!
>insert Abu Dhabi,1000
New record has been added successfully.
>insert Abu Dhabi,2000
Existing record has been updated.
>find Abu Dhabi
Zip code for Abu Dhabi is: 2000   (comparisons = 7)
>remove Abu Dhabi
Abu Dhabi has been successfully removed!
>find Abu Dhabi
Record not found!
>exit
```

CODE OF CONDUCT

All assignments are graded, meaning we expect you to adhere to the academic integrity standards of NYU Abu Dhabi. To avoid any confusion regarding this, we will briefly state what is and isn't allowed when working on an assignment/lab-task.

Any documents and program code that you submit must be fully written by yourself. You can, of course, discuss your ideas with fellow students, as long as these discussions are restricted to general solution techniques. Put differently, these discussions should not be about concrete code you are writing, nor about specific results you wish to submit. When discussing an assignment with others, this should never lead to you possessing the complete or partial solution of others, regardless of whether the solution is in paper or digital form, and independent of who made the solution, meaning you are also not allowed to possess solutions by someone from a different year or course, by someone from another university, or code from the Internet, etc. This also implies that there is never a valid reason to share your code with fellow students, and that there is no valid reason to publish your code online in any form.

Every student is responsible for the work they submit. If there is any doubt during the grading about whether a student created the assignment themselves (e.g. if the solution matches that of others), we reserve the option to let the student explain why this is the case. In case doubts remain, or we decide to directly escalate the issue, the suspected violations will be reported to the academic administration according to the policies of NYU Abu Dhabi.

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