===Lab Info===

* 90 points

* Due 11:59pm on Sunday, 9/20/2015 for Monday and Wednesday lab

==Assignment==

In this assignment, you will work on closed hashing with open addressing. You are to read in the numbers from a data file of integers. The first number is a prime number that shows the size of the hash table. The rest of the file contains the key numbers that should be inserted in the hash table. Use % (i.e., mod) as the hash function. The file of numbers you read from will be data.txt. You may hard code the file name in your program if you wish. In this lab, we will use linear probing with hi(x) = (h(x) + i) % m with rehashing. Don't forget that the elements are keys, so there should not be any duplicate elements in the hash table.

One important thing that you should pay attention to when implementing closed hashing is when you want to remove an element. In this case, we should distinguish between an empty bucket (no element has been placed in it during hashing) and a bucket that has become empty by deletion. To distinguish between these two situations, we should use an extra flag field. When the flag is true, it shows that the bucket is emptied by deletion and searching must continue. When the flag is false, it means that the bucket was empty from the beginning of the hashing process so searching terminates. Don't forget that when you want to insert an element into the hash table, you first have to search for it.

If the load factor is larger than 0.5, then you should rehash. Use the smallest prime number which is larger than two times the previous prime number used for the size of the hash table. Like the previous labs, a simple user interface should be designed to do some insertion and deletion into the hash table:

1- insert

2- delete

3- print

4- exit

===Hash===

The methods that should be implemented are as follows:

* insert(x) should insert x to the Hash table.

* remove(x) should remove the key from the hash table.

* print () should print out all the elements of the hash table.

* hash(x) Use hi(x) = (h(x) + i)% m for linear probing.

* contains(x) return true if the key x is in the hash table and false if not.

* isfull() return true if the hash table is full.

===Output===

file: 5 64 26

Please choose one of the following commands:

1- insert

2- delete

3- print

4- exit

> 3

0: -1 flag =false

1: 26 flag =false

2: -1 flag =false

3: -1   flag =false

4: 64 flag =false

Please choose one of the following commands:

1- insert

2- delete

3- print

4- exit

> 1

Which number do you want to insert into the hash table?

> 56

Please choose one of the following commands:

1- insert

2- delete

3- print

4- exit

> 3

0: -1 flag =false

1: 56 flag =false

2: -1 flag =false

3: -1   flag =false

4: 26 flag =false

5: -1 flag =false

6: -1 flag =false

7: -1 flag =false

8: -1 flag =false

9: 64 flag =false

10: -1 flag =false

Please choose one of the following commands:

1- insert

2- delete

3- print

4- exit

> 1

Which number do you want to insert into the hash table?

> 72

Please choose one of the following commands:

1- insert

2- delete

3- print

4- exit

> 3

0: -1 flag =false

1: 56 flag =false

2: -1 flag =false

3: -1   flag =false

4: 26 flag =false

5: -1 flag =false

6: 72 flag =false

7: -1 flag =false

8: -1 flag =false

9: 64 flag =false

10: -1 flag =false

Please choose one of the following commands:

1- insert

2- delete

3- print

4- exit

> 1

Which number do you want to insert into the hash table?

> 8

Please choose one of the following commands:

1- insert

2- delete

3- print

4- exit

> 3

0: -1 flag =false

1: 56 flag =false

2: -1 flag =false

3: -1   flag =false

4: 26 flag =false

5: -1 flag =false

6: 72 flag =false

7: -1 flag =false

8: 8 flag =false

9: 64 flag =false

10: -1 flag =false

Please choose one of the following commands:

1- insert

2- delete

3- print

4- exit

> 2

Which number do you want to remove from the hash table?

>26

Please choose one of the following commands:

1- insert

2- delete

3- print

4- exit

> 1

Which number do you want to insert into the hash table?

> 19

Please choose one of the following commands:

1- insert

2- delete

3- print

4- exit

> 3

0: -1 flag =false

1: 56 flag =false

2: -1 flag =false

3: -1   flag =false

4: -1 flag =true

5: -1 flag =false

6: 72 flag =false

7: -1 flag =false

8: 8 flag =false

9: 64 flag =false

10: 19 flag =false

Please choose one of the following commands:

1- insert

2- delete

3- print

4- exit

> 2

Which number do you want to remove from the hash table?

>8

Please choose one of the following commands:

1- insert

2- delete

3- print

4- exit

> 3

0: -1 flag =false

1: 56 flag =false

2: -1 flag =false

3: -1   flag =false

4: -1 flag =true

5: -1 flag =false

6: 72 flag =false

7: -1 flag =false

8: -1 flag =true

9: 64 flag =false

10: 19 flag =false

Please choose one of the following commands:

1- insert

2- delete

3- print

4- exit

> 1

Which number do you want to insert into the hash table?

> 19

Please choose one of the following commands:

1- insert

2- delete

3- print

4- exit

> 3

0: -1 flag =false

1: 56 flag =false

2: -1 flag =false

3: -1   flag =false

4: -1 flag =true

5: -1 flag =true

6: 72 flag =false

7: -1 flag =false

8: -1 flag =true

9: 64 flag =false

10: 19 flag =false

===Files===

* Files to include in folder:

** all source files

** a functioning makefile

** data.txt

* Folder name: Lastname_Lab3

* Compressed file name: Last_Lab3.zip (or .rar or .tar.gz)

* Executable name: lab3