GIT Department of Computer Engineering
CSE 222/505 - Spring 2021
Homework # Report

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1-PROBLEM SOLUTION APPROACH

Part 1

1-Identify The Problem

Problem is writing a custom iterator class MapIterator to iterate through the keys in a HashMap

2-Gather Information

MapIterator class will have next(), prev(), and hasNext() methods. next() method returns the next key in the Map. It returns the first key when there is no not-iterated key in the Map. prev() method returns the previous key in the Map. It returns the last key when the iterator is at the first key. hasNext() method returns True if there are still not-iterated key/s in the Map, otherwise returns False.

3-Iterate Potential Solutions

I created MyHashMap class and I hold MapIterator class as a inner class. In my getIterator() method which is in MyHashMap class, I return MapIterator object and in this way, I can call next(), prev() and hasNext() method in Main function.

Part 2

1-Identify The Problem

Problem is implementing KWHashMap interface using the chaining technique for hashing by using linked lists, using the chaining technique for hashing by using TreeSet and using the Coalesced hashing technique.

2-Gather Information

In this part, all 3 classes have get(Object key), rehash(), put(K key,V value) and remove(Object key) methods. get(Object key) method returns the value of given key if given key is found in table, otherwise return null. rehash() method allocates a new hash table that is double the size and reinsert each table entry in the new hash table. put(K key,V value) method inserts key-value pair in the table. If the key is already in the table, its value is changed to the argument value. It returns the old value associated with this key if found; otherwise, return null. remove(Object key) method removes proper entry from table according to given key and returns removed entry's value if given key is found in the table, otherwise returns null.

3-Iterate Potential Solutions

I created HashtableChainLinkedList, HashtableChainTreeSet and HashtableCoalesced classes for this part. For all these 3 classes, I hold Entry class as

a inner class. In HashtableChainLinkedList class, I hold table as a Linked List of entry. In HashtableChainTreeSet class, I hold table as a TreeSet of entry. In HashtableCoalesced class, I hold table as a entry.

2-TEST CASES

PART 1

1- The iterator starts from the given key if given key is in the Map

```
Key 4 is in the Map

Iterator points to key 4 at the beginning
Iterator hasNext: true
Iterator next: 4
Iterator next: 5
Iterator hasNext: false
Iterator next: 1
Iterator prev: 1
Iterator prev: 5
Iterator prev: 4
```

2- The iterator starts from any key in the Map when the starting key is not in the Map

```
Key 10 is not in the Map

Iterator points to key 1 at the beginning
Iterator hasNext: true
Iterator next: 1
Iterator next: 2
Iterator next: 3
Iterator prev: 3
Iterator prev: 2
Iterator prev: 1
```

3- The iterator starts from any key in the Map when the starting key is not specified

```
Starting key is not specified

Iterator points to key 3 at the beginning
Iterator hasNext: true
Iterator next: 3
Iterator next: 4
Iterator next: 5
Iterator prev: 5
Iterator prev: 4
Iterator prev: 3
```

4- If there are still not-iterated key/s in the Map

```
Iterator hasNext: true
```

5- If there are not any not-iterated key/s in the Map

```
Iterator hasNext: false
```

6- Prints the next key in the Map. It prints the first key when there is no not-iterated key in the Map.

```
Iterator next: 4
```

7- The iterator points to the previous key in the Map. It prints the last key when the iterator is at the first key.

```
Iterator prev: 1
```

PART 2

1-If key-value pair is inserted to HashTableChainLinkedList or HashtableChainTreeSet

```
Key 3 Value Test1 is inserted
```

2-If key-value pair is removed from HashTableChainLinkedList or HashtableChainTreeSet

```
Key 13 Value Test3 is removed
```

3- This is current position of HashTableChainLinkedList or HashtableChainTreeSet

```
Index - Key - Value
1-  51- Test6
2-  42- Test7   12- Test2
3-  23- Test5   3- Test1
5-  25- Test4
```

4- When getting value of key, if this key is found in table

```
Get key: 25 - Test4
```

5- When getting value of key, if this key is not found in table

```
Get key: 42 - null
```

6-Performance results of HashTable

```
Total time during this operations (ns):
134224128
```

3-RUNNING AND RESULTS

PART 1

```
PART 1

Key 4 is in the Map

Iterator points to key 4 at the beginning
Iterator hasNext: true
Iterator next: 4
Iterator next: 5
Iterator hasNext: false
Iterator next: 1
Iterator prev: 1
Iterator prev: 5
Iterator prev: 4


Key 10 is not in the Map

Iterator points to key 2 at the beginning
Iterator hasNext: true
Iterator next: 2
Iterator next: 3
Iterator next: 4
Iterator prev: 4
Iterator prev: 3
Iterator prev: 2


Starting key is not specified

Iterator points to key 5 at the beginning
Iterator hasNext: true
Iterator next: 5
Iterator next: 1
Iterator next: 2
Iterator prev: 2
Iterator prev: 1
Iterator prev: 5
```

PART 2

```
PART 2

LinkedList HashTable Chain

Key 3 Value Test1 is inserted
Key 12 Value Test2 is inserted
Key 13 Value Test3 is inserted
Key 25 Value Test4 is inserted
Key 23 Value Test5 is inserted
Key 51 Value Test6 is inserted
Key 42 Value Test7 is inserted
Key 13 Value Test3 is removed

LinkedList Hash table is below

Index - Key - Value
1-  51- Test6
2-  42- Test7   12- Test2
3-  23- Test5   3- Test1
5-  25- Test4

Get key: 25 - Test4
Key 42 Value Test7 is removed
Get key: 42 - null
Get key: 100 - null

Total time during this operations (ns):
134224128
```

```
TreeSet HashTable Chain

Key 3 Value Test1 is inserted
Key 12 Value Test2 is inserted
Key 13 Value Test3 is inserted
Key 25 Value Test4 is inserted
Key 23 Value Test5 is inserted
Key 51 Value Test6 is inserted
Key 42 Value Test7 is inserted
Key 13 Value Test3 is removed

TreeSet Hash table is below

Index - Key - Value
1-  51- Test6
2-  12- Test2   42- Test7
3-  3- Test1   23- Test5
5-  25- Test4

Get key: 3 - Test1
Key 23 Value Test5 is removed
Get key: 23 - null
Get key: 150 - null

Total time during this operations (ns):
14383469
```

```
HashTable Coalesced

Hash Value: 0   Key:    Next: NULL
Hash Value: 1   Key:    Next: NULL
Hash Value: 2   Key:    Next: NULL
Hash Value: 3   Key: 3   Next: NULL
Hash Value: 4   Key:    Next: NULL
Hash Value: 5   Key:    Next: NULL
Hash Value: 6   Key:    Next: NULL
Hash Value: 7   Key:    Next: NULL
Hash Value: 8   Key:    Next: NULL
Hash Value: 9   Key:    Next: NULL


Hash Value: 0   Key:    Next: NULL
Hash Value: 1   Key:    Next: NULL
Hash Value: 2   Key: 12   Next: NULL
Hash Value: 3   Key: 3   Next: NULL
Hash Value: 4   Key:    Next: NULL
Hash Value: 5   Key:    Next: NULL
Hash Value: 6   Key:    Next: NULL
Hash Value: 7   Key:    Next: NULL
Hash Value: 8   Key:    Next: NULL
Hash Value: 9   Key:    Next: NULL


Hash Value: 0   Key:    Next: NULL
Hash Value: 1   Key:    Next: NULL
Hash Value: 2   Key: 12   Next: NULL
Hash Value: 3   Key: 3   Next: 4
Hash Value: 4   Key: 13   Next: NULL
Hash Value: 5   Key:    Next: NULL
Hash Value: 6   Key:    Next: NULL
Hash Value: 7   Key:    Next: NULL
Hash Value: 8   Key:    Next: NULL
Hash Value: 9   Key:    Next: NULL


Hash Value: 0   Key:    Next: NULL
Hash Value: 1   Key:    Next: NULL
Hash Value: 2   Key: 12   Next: NULL
Hash Value: 3   Key: 3   Next: 4
Hash Value: 4   Key: 13   Next: NULL
Hash Value: 5   Key: 25   Next: NULL
Hash Value: 6   Key:    Next: NULL
Hash Value: 7   Key:    Next: NULL
Hash Value: 8   Key:    Next: NULL
Hash Value: 9   Key:    Next: NULL
```

```
Hash Value: 0   Key:    Next: NULL
Hash Value: 1   Key:    Next: NULL
Hash Value: 2   Key: 12   Next: NULL
Hash Value: 3   Key: 3   Next: 4
Hash Value: 4   Key: 13   Next: 7
Hash Value: 5   Key: 25   Next: NULL
Hash Value: 6   Key:    Next: NULL
Hash Value: 7   Key: 23   Next: NULL
Hash Value: 8   Key:    Next: NULL
Hash Value: 9   Key:    Next: NULL


Hash Value: 0   Key:    Next: NULL
Hash Value: 1   Key: 51   Next: NULL
Hash Value: 2   Key: 12   Next: NULL
Hash Value: 3   Key: 3   Next: 4
Hash Value: 4   Key: 13   Next: 7
Hash Value: 5   Key: 25   Next: NULL
Hash Value: 6   Key:    Next: NULL
Hash Value: 7   Key: 23   Next: NULL
Hash Value: 8   Key:    Next: NULL
Hash Value: 9   Key:    Next: NULL


Hash Value: 0   Key:    Next: NULL
Hash Value: 1   Key: 51   Next: NULL
Hash Value: 2   Key: 12   Next: 6
Hash Value: 3   Key: 3   Next: 4
Hash Value: 4   Key: 13   Next: 7
Hash Value: 5   Key: 25   Next: NULL
Hash Value: 6   Key: 42   Next: NULL
Hash Value: 7   Key: 23   Next: NULL
Hash Value: 8   Key:    Next: NULL
Hash Value: 9   Key:    Next: NULL


Total time during this operations (ns):
13395042
cse312@ubuntu:~/Desktop/data_hw5$
```