GIT Department of Computer Engineering
CSE 222/505 - Spring 2021
Homework 5 Report

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1. PROBLEM SOLUTION APPROACH

A custom iterator class MapIterator to iterate through the keys in a HashMap data structure in Java was written. This class have next,hasnext,prev methods.The chaining technique for hashing by using linked lists to chain items on the same table slot was used.The chaining technique for hashing by using TreeSet (instead of linked list) to chain items on the same table slot was used.The Coalesced hashing technique was used. This technique uses the concept of Open Addressing to find first empty place for colliding element by using the quadratic probing and the concept of Separate Chaining to link the colliding elements to each other through pointers (indices in the table). The deletion of a key is performed by linking its next entry to the entry that points the deleted key by replacing deleted entry by the next entry.

2. TEST CASES

1. Map Iterator functions was tried. (turkey -> france -> germany -> italy ex: turkey.next() is france)
2. Small, medium, and large-sized data were used for hash tables in suitable sizes for testing.(small = 10 , medium = 100, large = 1000)

3.RUNNING AND RESULTS

Test Iterator

```
HashMap is created!
Turkey , Ankara
England , London
Italy , Rome
France , Paris
Germany , Berlin
Iterator is created from Turkey!
Turkey
England
Italy
France
Germany
Iterator is created from Italy!
Italy
France
Germany
Turkey
England
```

Hash Tables tests for small size

```
----------TEST WITH SMALL SIZE----------
Coalesced Hash Table PUT operation time :
37900
Hash Table Chain with linked list PUT operation time :
1739300
Hash Table Chain with tree set PUT operation time :
2473500
Coalesced Hash Table GET operation time :
24600
Hash Table Chain with linked list GET operation time :
28000
Hash Table Chain with tree set GET operation time :
177200
Coalesced Hash Table REMOVE operation time :
13200
Hash Table Chain with linked list REMOVE operation time :
60000
Hash Table Chain with tree set REMOVE operation time :
215100
Coalesced Hash Table REMOVE operation time with non existing elements:
11100
Hash Table Chain with linked list REMOVE operation time with non existing elements:
4200
Hash Table Chain with tree set REMOVE operation time with non existing elements:
200400
Coalesced Hash Table GET operation time  with non existing elements :
23000
Hash Table Chain with linked list GET operation time  with non existing elements :
3800
Hash Table Chain with tree set GET operation time  with non existing elements :
150600
          TEST WITH MEDIUM SIZE
```

Hash Tables tests for medium size

```
--------------TEST WITH MEDIUM SIZE------------------
Coalesced Hash Table PUT operation time :
500100
Hash Table Chain with linked list PUT operation time :
154400
Hash Table Chain with tree set PUT operation time :
393100
Coalesced Hash Table GET operation time :
169900
Hash Table Chain with linked list GET operation time :
152800
Hash Table Chain with tree set GET operation time :
248600
Coalesced Hash Table REMOVE operation time :
57300
Hash Table Chain with linked list REMOVE operation time :
407400
Hash Table Chain with tree set REMOVE operation time :
442000
Coalesced Hash Table REMOVE operation time with non existing elements:
74900
Hash Table Chain with linked list REMOVE operation time with non existing elements:
41400
Hash Table Chain with tree set REMOVE operation time with non existing elements:
250900
Coalesced Hash Table GET operation time  with non existing elements :
22100
Hash Table Chain with linked list GET operation time  with non existing elements :
9900
Hash Table Chain with tree set GET operation time  with non existing elements :
217700
```

Hash Tables tests for large size

```
217700
--------------TEST WITH LARGE SIZE------------------
Coalesced Hash Table PUT operation time :
924800
Hash Table Chain with linked list PUT operation time :
2114900
Hash Table Chain with tree set PUT operation time :
3801300
Coalesced Hash Table GET operation time :
144100
Hash Table Chain with linked list GET operation time :
299300
Hash Table Chain with tree set GET operation time :
1175200
Coalesced Hash Table REMOVE operation time :
209700
Hash Table Chain with linked list REMOVE operation time :
1247400
Hash Table Chain with tree set REMOVE operation time :
1782500
Coalesced Hash Table REMOVE operation time with non existing elements:
428000
Hash Table Chain with linked list REMOVE operation time with non existing elements:
57300
Hash Table Chain with tree set REMOVE operation time with non existing elements:
207400
Coalesced Hash Table GET operation time  with non existing elements :
253600
Hash Table Chain with linked list GET operation time  with non existing elements :
39900
Hash Table Chain with tree set GET operation time  with non existing elements :
206000
```