CSE12 - Lecture 17

Wednesday, May 8, 2024 10:00 AM

Exam 2 - May 15th

- https://ucsd-cse12-sp24.github.io/lectures/exam2.html

Lecture 17

Map and HashTable

Hash Function (same as previous)

```
int getIndex(String k) {
    return k.length;
}
```

# of buckets – 4
(i.e. the size of the array)

expandCapacity() called in set()

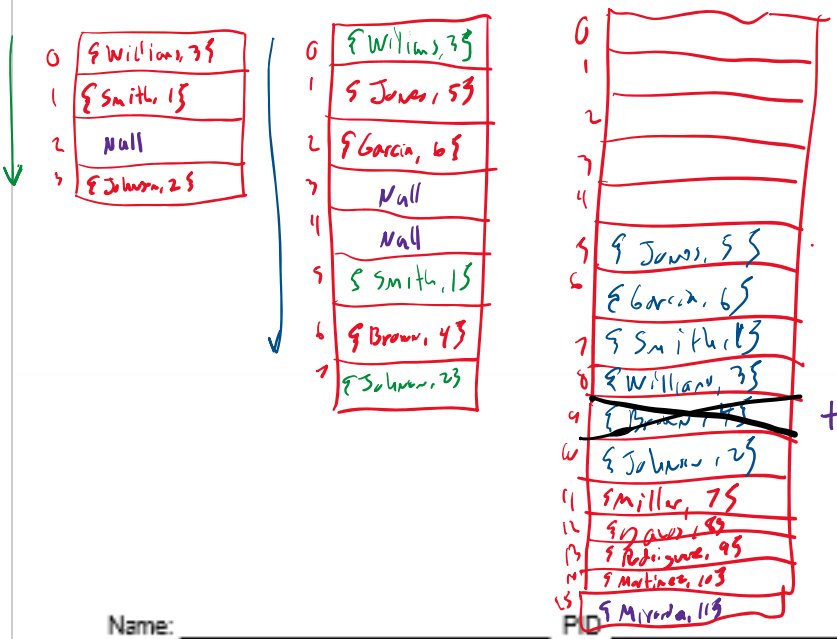
LoadFactor – 0.07 (Python)

```
set("Smith", 1);
set("Johnson", 2);
set("Williams", 3);
set("Brown", 4);
set("Jones", 5);
set("Garcia", 6);
set("Miller", 7);
set("Davis", 8);
set("Rodriguez", 9);
set("Martinez", 10);
```

hash	index	LF
5	1 → 5	1/4
7	3	2/4
8	0 0 8	3/4 3/8
5	5	4/8
5	5	5/8
6	6	6/8 7/16
6	6	7/16
5	5	8/16
9	9	9/16
10	10	10/16

Draw the picture of the HashTable using Linear Probing (using expandCapacity)

KeyValue pair <String, Integer> [ ]



What is the run-time for this HashTable (do picture first):

set()

Worst Case: $\Theta(N^2)$

Best Case: $\Theta(1)$

What conditions make up the best case for set()?

No collisions, no EC

get()

Worst Case: $\Theta(N)$

Best Case: $\Theta(1)$

What conditions make up the best case for get()?

No collisions

What happens if we remove something, then try to find something that collided it?

```
remove("Brown");
get("Davis");
```

tombstone → key = null; in word from KeyValue Pair .equals() return false

→ expand capacity
↳ remove during rehash

What happens if we add something else?

```
set("Miranda", 11);
```

Name: _____ PID: _____ Code: 7443

Amortized Analysis

What is the run-time for ArrayList add()?

Worst Case: $\Theta(1) \rightarrow \Theta(N) \rightarrow \Theta(N)$

Best Case: $\Theta(1)$

Average Case: $\Theta(1)$ per add

find()

wc	N
bc	1
ac	$\frac{N}{2}$

binary search
↳ sort → $N(\log_2(N))$
$\log_2(N)$

What is the run-time for HashTable set() using Separate Chaining and a good hash function? .75lf

set()

Worst Case: $\Theta(1) \rightarrow \Theta(N) + \Theta(N)$

Best Case: $\Theta(1)$

Average Case: $\Theta(1)$ per add

Why is the hash function important?

even distribution
↳ less/no collisions

Object
↳ int hashcode()

Strings
↳ int hashcode()
override

get

wc	$\Theta(N)$
bc	$\Theta(1)$
ac	$\Theta(1)$

What is the run-time for HashTable set() using Linear Probing and a good hash function? .67lf

set()

Worst Case: $\Theta(1) + \Theta(N) + \Theta(N)$

Best Case: $\Theta(1)$

Average Case: $\Theta(1)$ per add

2 → 4 → 8 → 16 → 32 → 64

$\Theta(1)$ per add

1024

2.
4.
8.
16.
32.
64.
128.
256.
512.
1024.

Call on EC 9 times