

极客大学算法训练营

第五课

哈希表、映射、集合

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Hash table

哈希表（Hash table），也叫散列表，是根据关键码值（Key value）而直接进行访问的数据结构。

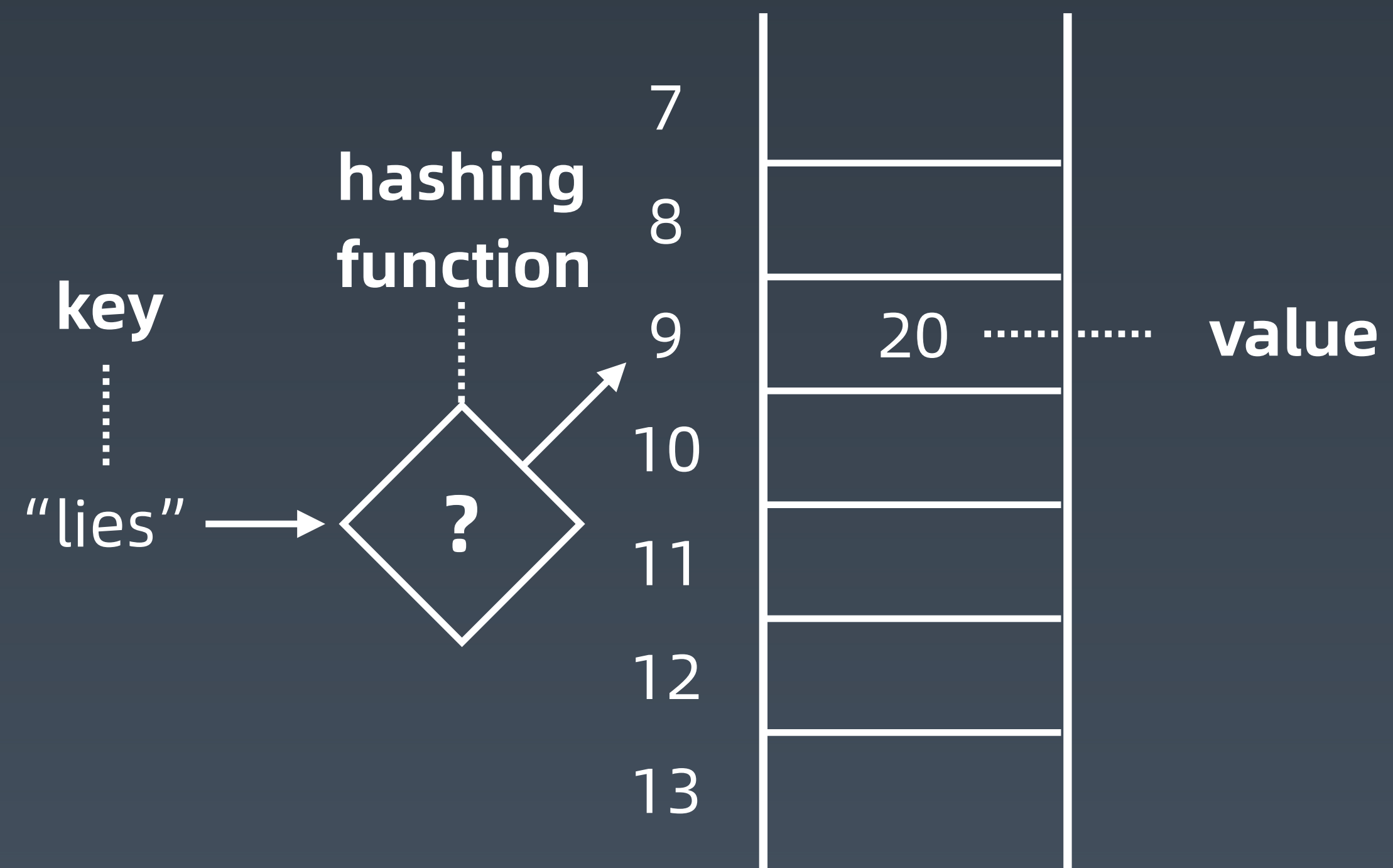
它通过把关键码值映射到表中一个位置来访问记录，以加快查找的速度。

这个映射函数叫作散列函数（Hash Function），存放记录的数组叫作哈希表（或散列表）。

工程实践

- 电话号码簿
- 用户信息表
- 缓存 (LRU Cache)
- 键值对存储 (Redis)

Hash Function



" l i e s "

↓ ↓ ↓ ↓

$$108 + 105 + 101 + 115 = 429$$

Hash Collisions

" l i e s "

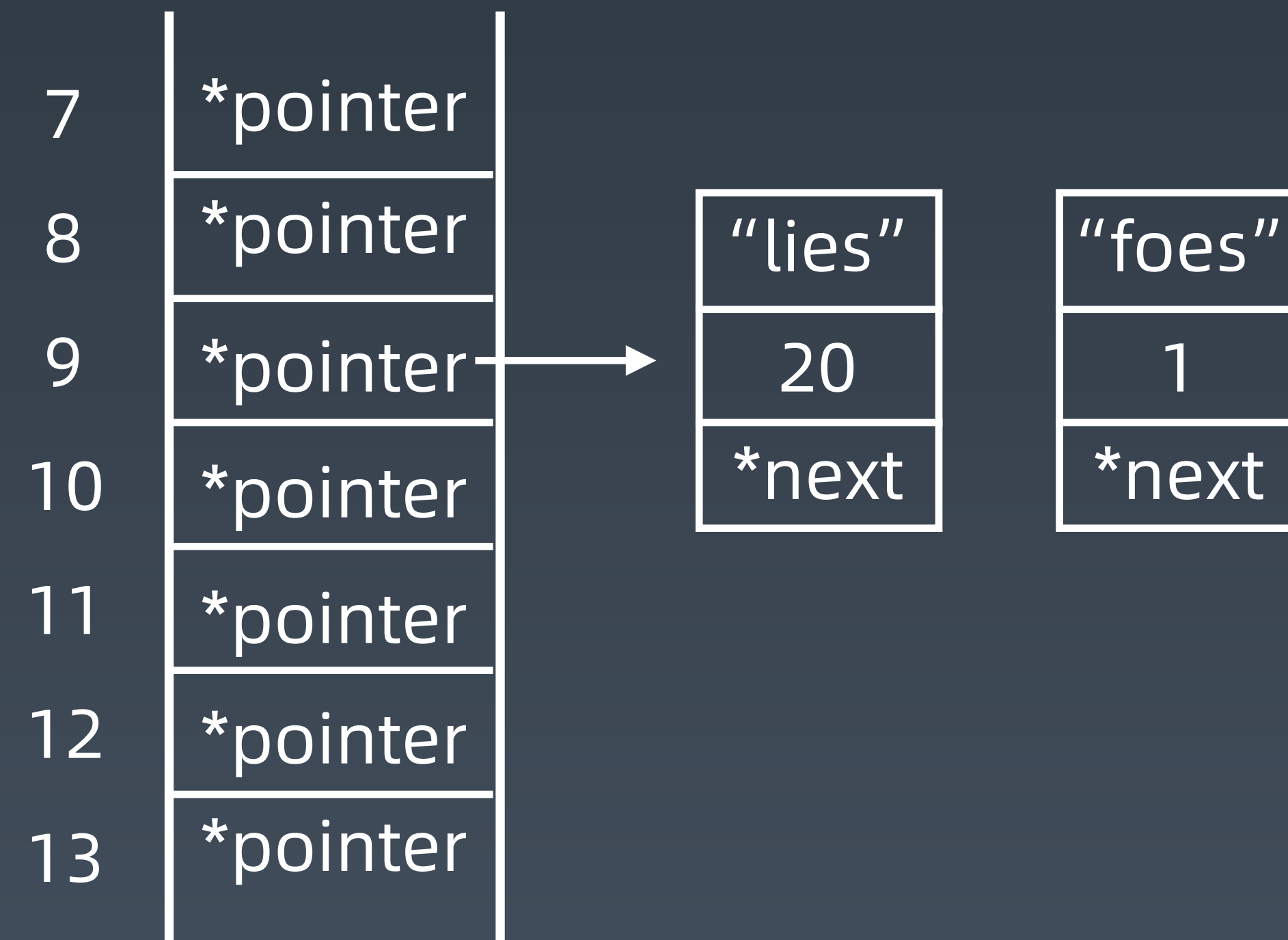
↓ ↓ ↓ ↓

$108 + 105 + 101 + 115 = 429$

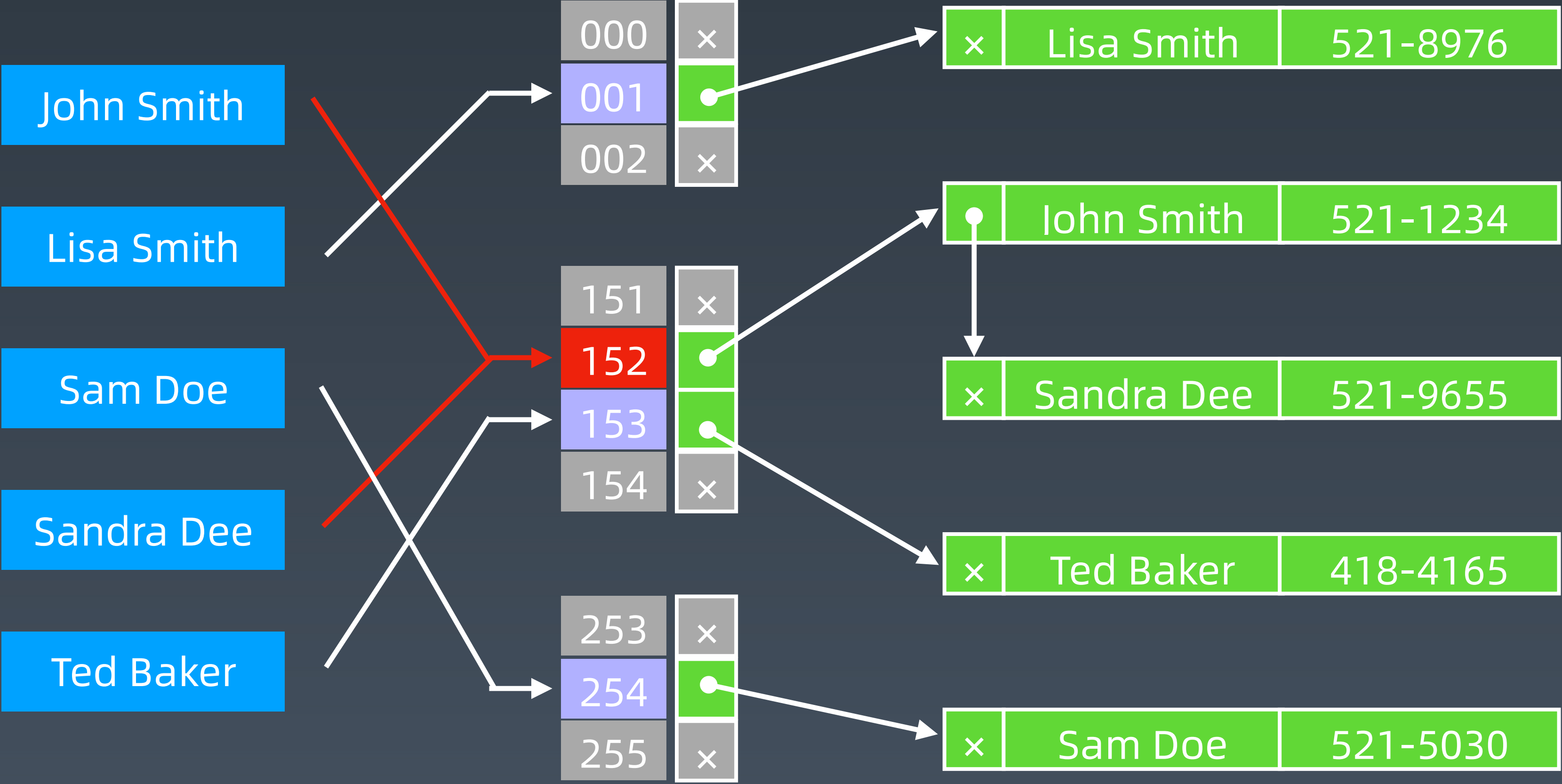
$108 + 105 + 101 + 115 =$

↑ ↑ ↑ ↑

" f o e s "



完整结构



复杂度分析

Data Structure	Time Complexity								Space Complexity
	Average				Worst				Worst
	Access	Search	Insertion	Deletion	Access	Search	Insertion	Deletion	
<u>Array</u>	$\theta(1)$	$\theta(n)$	$\theta(n)$	$\theta(n)$	$\theta(1)$	$\theta(n)$	$\theta(n)$	$\theta(n)$	$\theta(n)$
<u>Stack</u>	$\theta(n)$	$\theta(n)$	$\theta(1)$	$\theta(1)$	$\theta(n)$	$\theta(n)$	$\theta(1)$	$\theta(1)$	$\theta(n)$
<u>Queue</u>	$\theta(n)$	$\theta(n)$	$\theta(1)$	$\theta(1)$	$\theta(n)$	$\theta(n)$	$\theta(1)$	$\theta(1)$	$\theta(n)$
<u>Singly-Linked List</u>	$\theta(n)$	$\theta(n)$	$\theta(1)$	$\theta(1)$	$\theta(n)$	$\theta(n)$	$\theta(1)$	$\theta(1)$	$\theta(n)$
<u>Doubly-Linked List</u>	$\theta(n)$	$\theta(n)$	$\theta(1)$	$\theta(1)$	$\theta(n)$	$\theta(n)$	$\theta(1)$	$\theta(1)$	$\theta(n)$
<u>Skip List</u>	$\theta(\log(n))$	$\theta(\log(n))$	$\theta(\log(n))$	$\theta(\log(n))$	$\theta(n)$	$\theta(n)$	$\theta(n)$	$\theta(n)$	$\theta(n \log(n))$
<u>Hash Table</u>	N/A	$\theta(1)$	$\theta(1)$	$\theta(1)$	N/A	$\theta(n)$	$\theta(n)$	$\theta(n)$	$\theta(n)$
<u>Binary Search Tree</u>	$\theta(\log(n))$	$\theta(\log(n))$	$\theta(\log(n))$	$\theta(\log(n))$	$\theta(n)$	$\theta(n)$	$\theta(n)$	$\theta(n)$	$\theta(n)$
<u>Cartesian Tree</u>	N/A	$\theta(\log(n))$	$\theta(\log(n))$	$\theta(\log(n))$	N/A	$\theta(n)$	$\theta(n)$	$\theta(n)$	$\theta(n)$
<u>B-Tree</u>	$\theta(\log(n))$	$\theta(\log(n))$	$\theta(\log(n))$	$\theta(\log(n))$	$\theta(\log(n))$	$\theta(\log(n))$	$\theta(\log(n))$	$\theta(\log(n))$	$\theta(n)$
<u>Red-Black Tree</u>	$\theta(\log(n))$	$\theta(\log(n))$	$\theta(\log(n))$	$\theta(\log(n))$	$\theta(\log(n))$	$\theta(\log(n))$	$\theta(\log(n))$	$\theta(\log(n))$	$\theta(n)$
<u>Splay Tree</u>	N/A	$\theta(\log(n))$	$\theta(\log(n))$	$\theta(\log(n))$	N/A	$\theta(\log(n))$	$\theta(\log(n))$	$\theta(\log(n))$	$\theta(n)$
<u>AVL Tree</u>	$\theta(\log(n))$	$\theta(\log(n))$	$\theta(\log(n))$	$\theta(\log(n))$	$\theta(\log(n))$	$\theta(\log(n))$	$\theta(\log(n))$	$\theta(\log(n))$	$\theta(n)$
<u>KD Tree</u>	$\theta(\log(n))$	$\theta(\log(n))$	$\theta(\log(n))$	$\theta(\log(n))$	$\theta(n)$	$\theta(n)$	$\theta(n)$	$\theta(n)$	$\theta(n)$

Java code

- Map: key-value对, key不重复
 - new HashMap() / new TreeMap()
 - map.set(key, value)
 - map.get(key)
 - map.has(key)
 - map.size()
 - map.clear()
- Set: 不重复元素的集合
 - new HashSet() / new TreeSet()
 - set.add(value)
 - set.delete(value)
 - set.hash(value)

Python code

```
list_x = [1, 2, 3, 4]
```

```
map_x = {  
    'jack': 100,  
    '张三': 80,  
    'selina': 90,  
    ...  
}
```

```
set_x = {'jack', 'selina', 'Andy'}  
set_y = set(['jack', 'selina', 'jack'])
```

Map, Set : interfaces

- Java set classes:
TreeSet, HashSet,
ConcurrentSkipListSet, CopyOnWriteArraySet, EnumSet, JobState
Reasons, LinkedHashSet
<https://docs.oracle.com/en/java/javase/12/docs/api/java.base/java/util/Set.html>
- Java map classes:
HashMap, Hashtable, ConcurrentHashMap
<https://docs.oracle.com/en/java/javase/12/docs/api/java.base/java/util/Map.html>

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实战题目

1. <https://leetcode-cn.com/problems/valid-anagram/description/>
2. <https://leetcode-cn.com/problems/group-anagrams/>
3. <https://leetcode-cn.com/problems/two-sum/description/>

小技巧

养成收藏精选代码的习惯: <https://shimo.im/docs/R6g9WJV89QkHrDhr>

THANKS! |  极客大学