Competitive Programming Lectures-2

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Recap:

- Why competitive programming
- Introduction to Algoleague
- Fibonacci Numbers
- Fast Exponentiation

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Fibonacci continued: Why doesn't this work?

$$F_n = \frac{\varphi^n - (1-\varphi)^n}{\sqrt{5}}$$

Why don't we just use this formula?
We even know how to fast exponentiate!

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Small Experiment

Try this:

```
print(0.1 + 0.1 == 0.2)
```

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Small Experiment

Try this:

```
print(0.1 + 0.1 == 0.2)
```

Now this:

```
print(0.1 + 0.2 == 0.3)
```

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Small Experiment

Try this:

```
print(0.1 + 0.1 == 0.2)
```

Now this:

```
print(0.1 + 0.2 == 0.3)
```

Here is the reason:

```
print(0.1 + 0.2)
```

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Lesson to Learn

me: computer are awesome, it can calculate big numbers!

me: *tried programming 0.1 + 0.2*

computer:

Don’t mess with floats!

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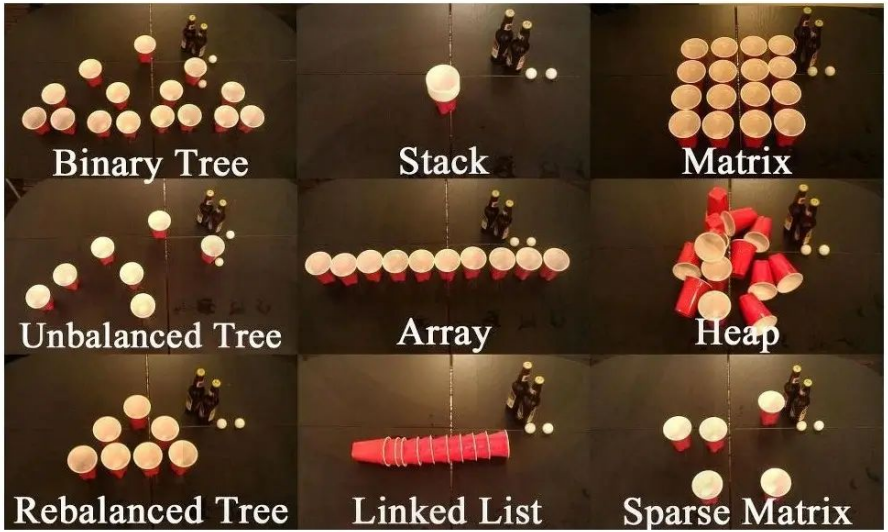
Today's Plan - Data Structures

- Lists
- Linked List
- Stack
- Queue
- Sets
- Hash maps



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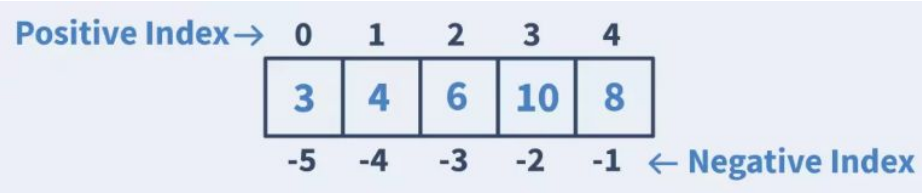
Lists (Python Lists / Arrays)



Reaching an **index**

Finding an **element** if list is **not sorted**

Finding an **element** if **sorted**

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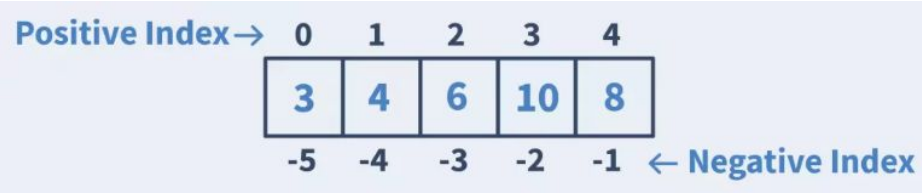
Lists (Python Lists / Arrays)



Reaching an **index** O(1)

Finding an **element** if list is **not sorted**

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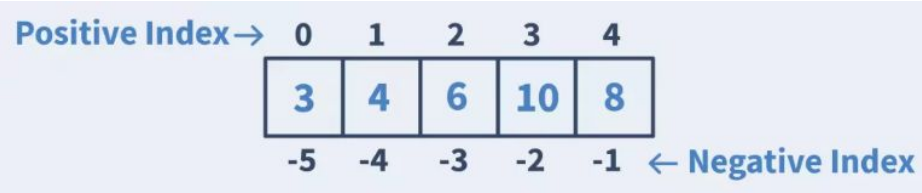
Lists (Python Lists / Arrays)



Reaching an **index**	O(1)
Finding an **element** if list is **not sorted**	O(n)
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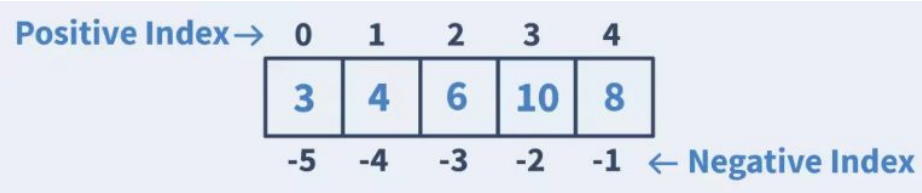
Lists (Python Lists / Arrays)



Reaching an **index**	O(1)
Finding an **element** if list is **not sorted**	O(n)
Finding an **element** if **sorted**	O(logn)

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Tricks for Lists

Strings are also lists! (Lists of chars)

- So if you are given a looong string, you don’t need to cast it to a list.
- Memorizing stuff on strings may help with the memory management.

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List Continued

What is the complexity of removing the element at a given index?

List Continued

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O(n)

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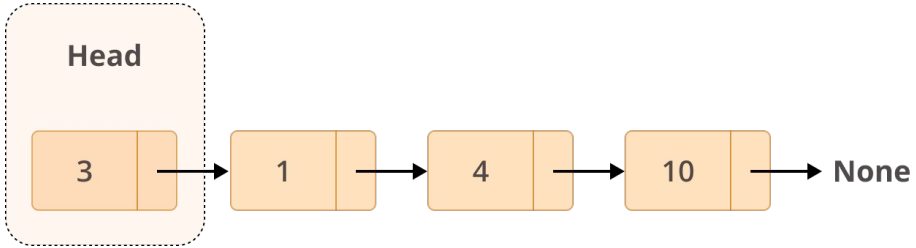
List Continued

What is the complexity of removing the element at a given index?

O(n)

A better implementation is **Linked List**s:



O(1)

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Valid Parentheses

({ { } }) [ ])

Is the Expression Balanced or Not?

With your group, come up with an algorithm that can detect balanced and unbalanced parentheses.
You have **5 minutes**.

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Stack and Queue

Queue Data Structure

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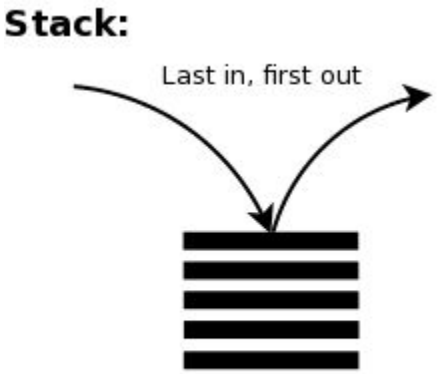
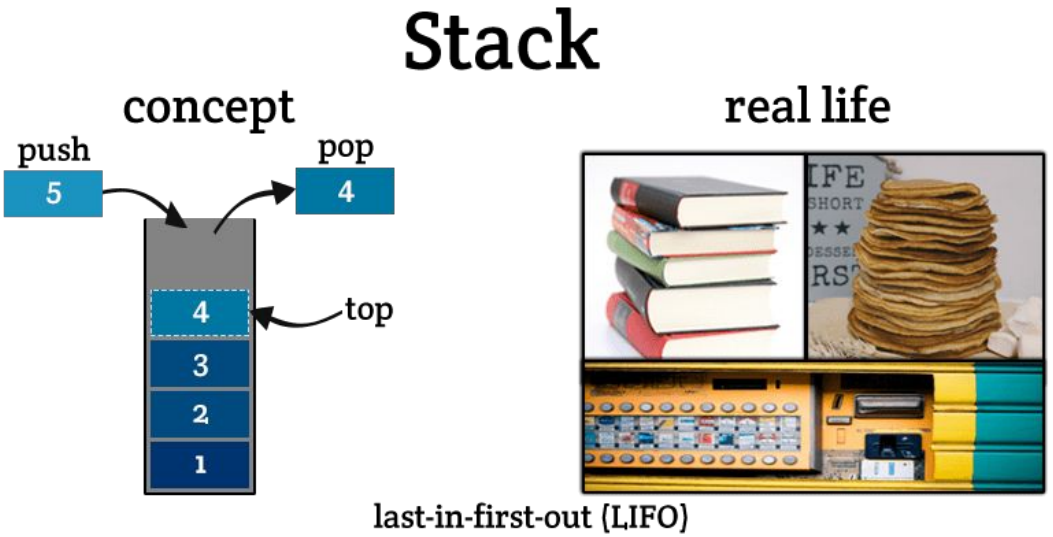
Stack and Queue





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Stack Methods

- **maxsize** – Number of items allowed in the queue.
- **empty()** – Return True if the queue is empty, False otherwise.
- **full()** – Return True if there are *maxsize* items in the queue. If the queue was initialized with maxsize=0 (the default), then full() never returns True.
- **get()** – Remove and return an item from the queue. If the queue is empty, wait until an item is available.
- **get_nowait()** – Return an item if one is immediately available, else raise QueueEmpty.
- **put(item)** – Put an item into the queue. If the queue is full, wait until a free slot is available before adding the item.
- **put_nowait(item)** – Put an item into the queue without blocking. If no free slot is immediately available, raise QueueFull.
- **qsize()** – Return the number of items in the queue.

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Back to Parentheses

Let’s solve the valid parentheses question using one of the data structures we learned so far.

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Sets

- Sets contain only **unique** elements.

- Can’t use index operations

- Two types:
  - **Unordered set**
  - **Ordered set (Binary Search Tree)**

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Sets - Complexity (Unordered)

Reaching an element

Adding a new element **O(1)**

Removing an element

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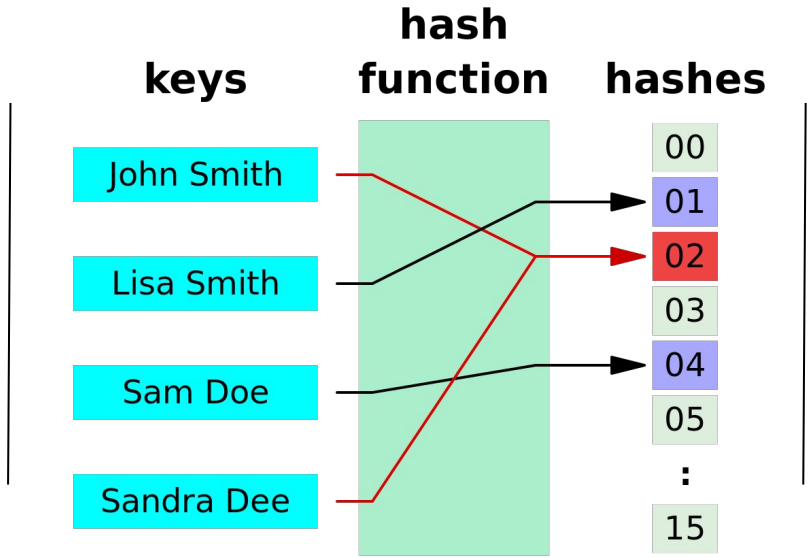
Hashing



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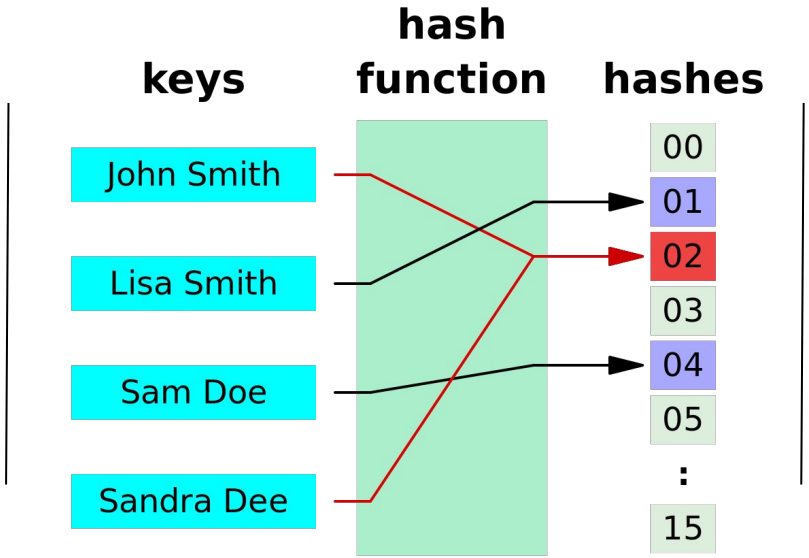
Hashing

They are immutable

Hashable data types

- Strings
- Integers
- Floats
- Boolean
- Bytes
- Functions
- Classes



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Hashing

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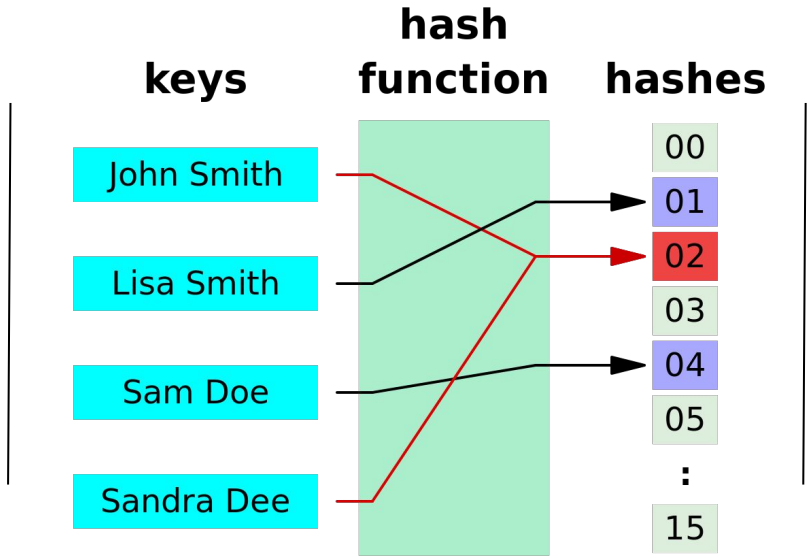

Outcome

- 65069253969181739 90
- 179904327190
- 938493150664577197

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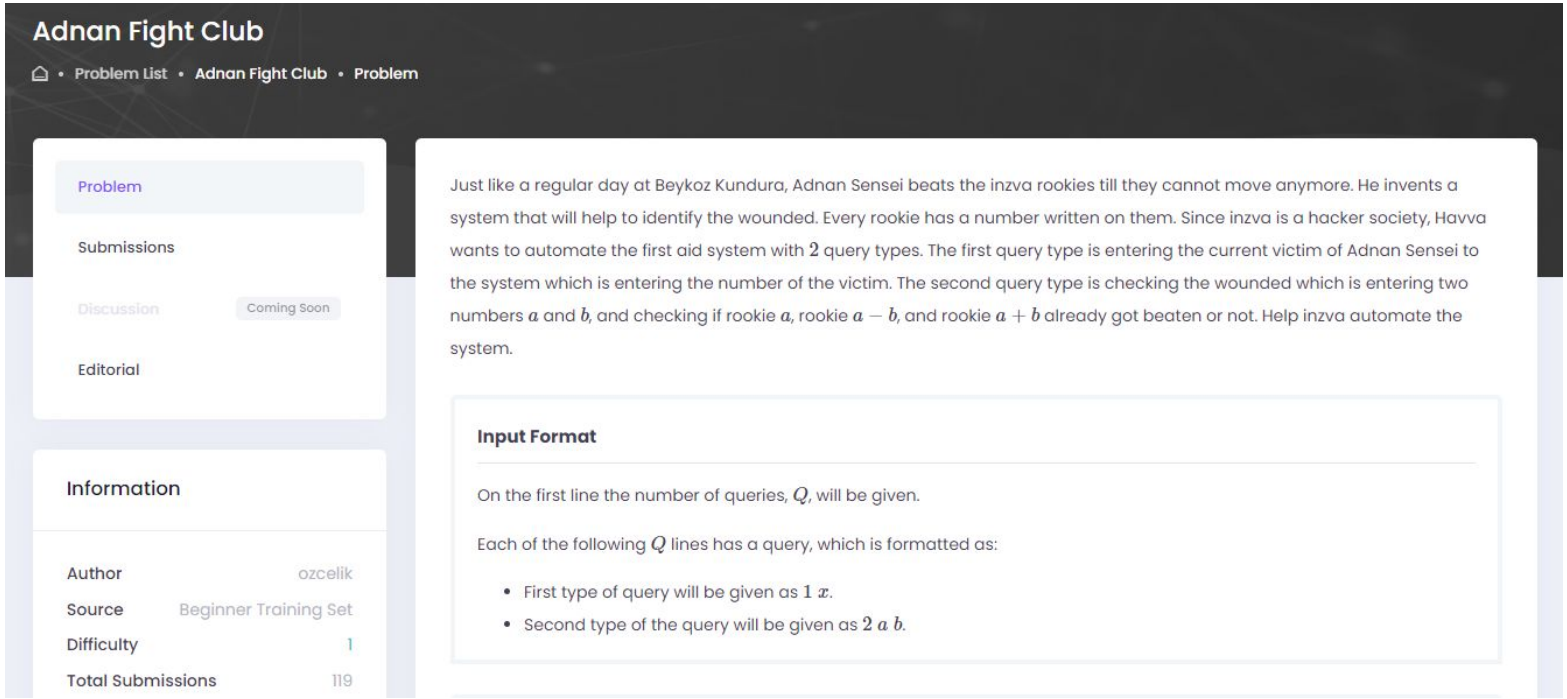
Let's Solve a Question!



Adnan Fight Club

Problem List • Adnan Fight Club • Problem

Problem

Submissions

Discussion Coming Soon

Editorial

Information

Author	ozcelik
Source	Beginner Training Set
Difficulty	1
Total Submissions	119

Just like a regular day at Beykoz Kundura, Adnan Sensei beats the inzva rookies till they cannot move anymore. He invents a system that will help to identify the wounded. Every rookie has a number written on them. Since inzva is a hacker society, Havva wants to automate the first aid system with 2 query types. The first query type is entering the current victim of Adnan Sensei to the system which is entering the number of the victim. The second query type is checking the wounded which is entering two numbers a and b, and checking if rookie a, rookie $a - b$, and rookie $a + b$ already got beaten or not. Help inzva automate the system.

Input Format

On the first line the number of queries, Q, will be given.

Each of the following Q lines has a query, which is formatted as:

- First type of query will be given as $1\ x$.
- Second type of the query will be given as $2\ a\ b$.

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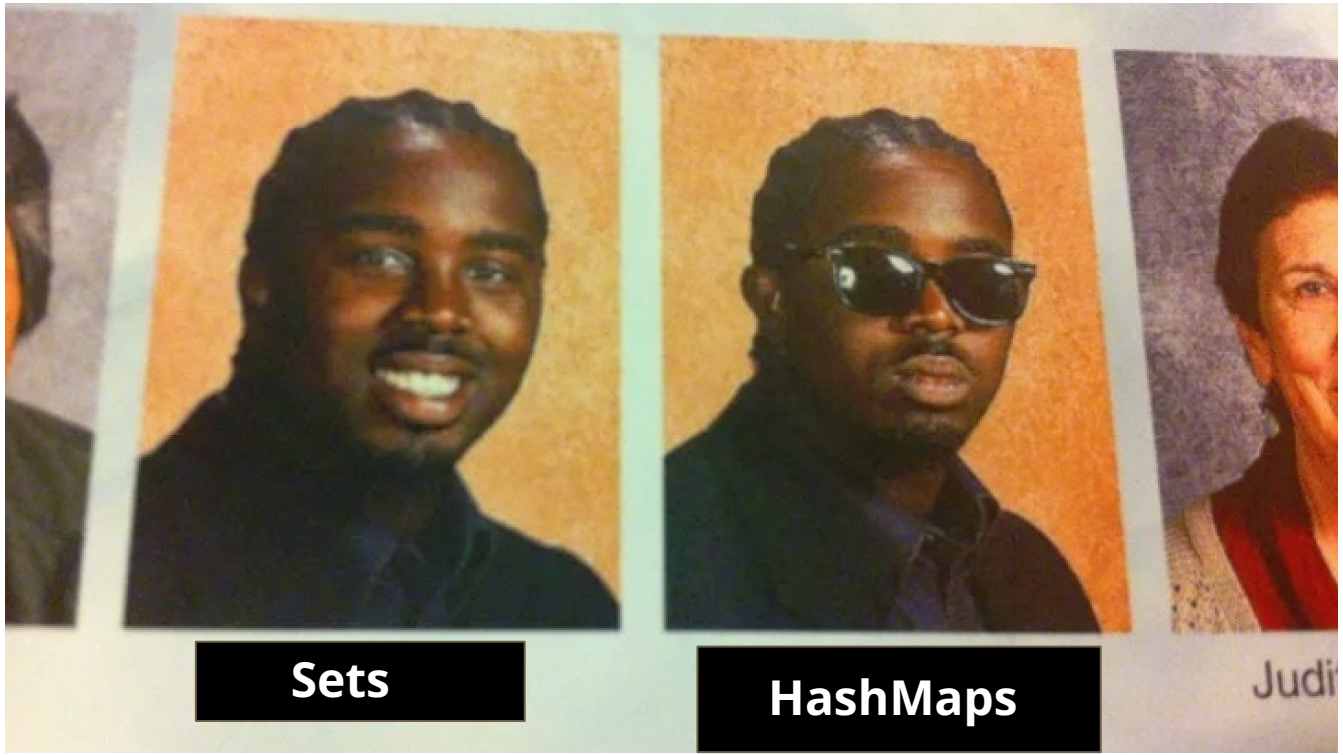
HashMap (Dictionary / Map)



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HashMap (Dictionary / Map)

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Hashmap Tricks

What if I try to reach a non-existent key?

Hashmap Tricks

What if I try to reach a non-existent key?

```
numberDict = {}
for i in range(10):
    if i != 5:
        numberDict[i] = 1

helper = 0
for i in range(10):
    helper = numberDict[i]

```

```
Traceback (most recent call last):
  File "C:\Users\Deniz\PycharmProjects\lesso
    helper = numberDict[i]
KeyError: 5
```

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How I used to solve this problem

```python
numberDict = {}
for i in range(10):
    if i != 5:
        numberDict[i] = 1

helper = 0
for i in range(10):
    try:
        helper = numberDict[i]
    except KeyError:
        pass
```

There are much better solutions than try, except

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O(1) Check

```
numberDict = {}
for i in range(10):
    if i != 5:
        numberDict[i] = 1

helper = 0
for i in range(10):
    if i in numberDict:
        helper = numberDict[i]

```

Don’t forget that checking if an element exists is O(1). Use that

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Cleaner Way

```
numberDict = {}
for i in range(10):
    if i != 5:
        numberDict[i] = 1

helper = 0
for i in range(10):
    helper = numberDict.get(i, -1)

```

dict.get(key) is the same as dict[key]

dict.get(key, -1) returns -1 if key not found!

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End Feedback

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