LEC 08

# CSE 122

## Sets, For-Each Loops, Iterators

Questions during Class?

Raise hand or send here

sli.do

BEFORE WE START

***Slido vote & chat with neighbors:***
*What's the last movie you watched?*

Music: 122 26Wi Lecture Tunes ⛄

**Instructor:** Adrian Salguero

**TAs:**
Ava
Blake R
Blake P
Cady
Caleb
Cole
Colin
Connor
Dalton
Dani
David
Diya
Hanna
Ivy
Mahima
Medha
Neal
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Nicolae
Nicole
Rio
Rohan
Saachi
Shreya
Shreyank
Sthiti
Sushma
Suyash
TJ
Wesley
Yang

# Lecture Outline

- **Announcements** ◀
- Practice Problem
- Sets Review
- Tradeoffs with Different Data Structures
- For-Each Loop
- Iterators

# Announcements

- Programming Assignment 1 (P1) due tomorrow!
  - Stacks, Queues, Exceptions
- Resubmission Cycle 1 was due yesterday
  - Remember that grades from a resubmission **completely replace** your previous grades for that assignment
  - Resubmission Cycle 2 will open tomorrow
- Heads up: Quiz 1 scheduled for Tuesday, February 17th
  - `ArrayLists`, Reference Semantics, Stacks and Queues, `Sets`, Maps
- How to Use the IPL
- Programming Assignment 2 released on Friday, February 6th
  - Yes, two Programming Assignments in a row!
  - BUT, you have one and a half week to complete this assignment

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# Practice Problem:

Write a program that, given a `Scanner` over a large text file (e.g., *Moby Dick* or the King James Bible), counts the number of unique words in the text.

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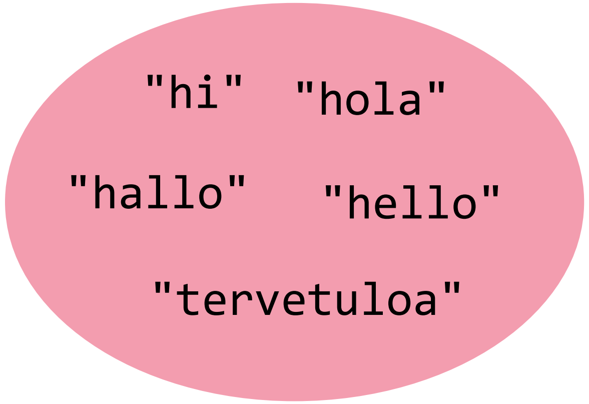
# (PCM) Sets (ADT)

- A collection of unique values (no duplicates allowed!) that can perform the following operations efficiently:
  - add
  - remove
  - search (contains)



"hi" "hola"

"hallo" "hello"

"tervetuloa"

- We don’t think of a set as having indices; we just add things to the set in general and don’t worry about order

# (PCM) Sets in Java

- `Set` is an interface in Java
  - In `java.util` package

- `HashSet` and `TreeSet` are classes that implement the `Set` interface in Java
  - `HashSet`: Very fast! Implemented using a “hash table” array
    - *Elements are stored in an unpredictable order*
  - `TreeSet`: Pretty fast! Implemented using a “binary search tree”
    - *Elements are stored in sorted order*

# Set Methods

| Method | Description |
|---|---|
| `add(value)` | Adds the given value to the set, returns whether or not the given value was added successfully |
| `contains(value)` | Returns `true` if the given value is found in this set |
| `remove(value)` | Removes the given value from the set; returns `true` if the set contained the value, `false` if not |
| `clear()` | Removes all elements from the set |
| `size()` | Returns the number of elements in list |
| `isEmpty()` | Returns `true` if the set's size is 0; `false` otherwise |
| `toString()` | Returns a `String` representation of the set such as `"[3, 42, -7, 15]"` |

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# Choosing a Data Structure: Tradeoffs

- You got a bit of practice with this in your quiz sections on Tuesday!
  - Solving the same problem with an `ArrayList`, a `Stack`, and a `Queue`

- Things to consider:
  - Functionality
    - If you need duplicates or indexing, `Set`s are not for you!
  - Efficiency
    - Different data structures are “good at” different things!

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- **For-Each Loop** ◀
- Iterators

# For-Each Loop

- A new kind of loop!

```
Set<String> words = new HashSet<>();
for (String s : words) {
    System.out.println(s);
}
```

- BUT, you cannot <u>modify</u> the data structure inside a for-each loop
  - You will get a `ConcurrentModificationException`
  - They are "read-only"

# Practice : Think

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## What output is produced by this code?

```
Set<Integer> nums = new TreeSet<>();
nums.add(3);
nums.add(9);
nums.add(3);
nums.add(-2);
nums.add(0);

for (int n : nums) {
    System.out.print(n + " ");
}
```

A. -2 0 3 9

B. 3 9 3 -2 0

C. 9 3 0 -2

D. -2 0 3 3 9

E. ConcurrentModificationException

# Practice : Pair

## What output is produced by this code?

```
Set<Integer> nums = new TreeSet<>();
nums.add(3);
nums.add(9);
nums.add(3);
nums.add(-2);
nums.add(0);

for (int n : nums) {
    System.out.print(n + " ");
}
```

A. -2 0 3 9

B. 3 9 3 -2 0

C. 9 3 0 -2

D. -2 0 3 3 9

E. `ConcurrentModificationException`

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# Iterators

A new object that has access to all of the elements of a given structure and can give them to you, one at a time.

# Iterators

- Returned by the `iterator()` method

| Methods | Description |
|---|---|
| `hasNext()` | Returns `true` if there are more elements for the iterator to return |
| `next()` | Returns the next element in the iteration |
| `remove()` | Removes and returns the element that was last returned by `next()` |

- You must use the iterator's `remove()` method to remove things from what you're iterating over – otherwise you will get a `ConcurrentModificationException`