LEC 08

CSE 122

Sets, For-Each Loops, Iterators

Questions during Class?

Raise hand or send here

sli.do

BEFORE WE START

Talk to your neighbors:

Did you eat breakfast today?

Music: 122 24sp Lecture Tunes 🌼

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Lecture Outline

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

Announcements

- Programming Assignment 1 (P1) due tomorrow, Thursday, April 25!
  - Stacks, Queues, Exceptions
- Resubmission Cycle 1 was due yesterday
  - Resubmission Cycle 2 will open tomorrow
- Heads up: Quiz 1 scheduled for Tuesday, May 7
  - Reference Semantics, Stacks and Queues, Sets, Maps
- How to Use the IPL
- 122 Playground
- Programming Assignment 2 releases on Friday, April 26
  - Yes, two Programming Assignments in a row
  - BUT, you have *two weeks* 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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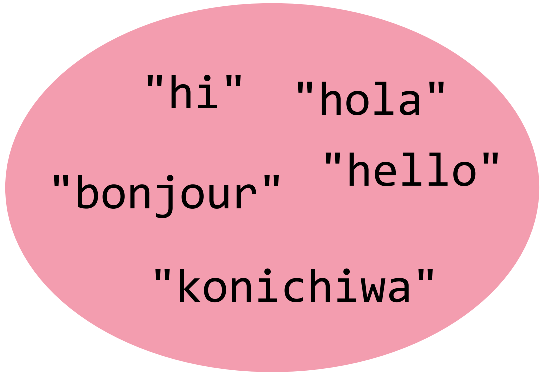
(PCM) Sets (ADT)

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



- 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`
  - Just like `List` and `Queue` are interfaces

- `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*
    - Learn more about “Hashing” in CSE 332/CSE 373
  - `TreeSet`: Pretty fast! Implemented using a “binary search tree”
    - *Elements are stored in sorted order*
    - *Learn more about “Trees” in CSE 123*
  - Just like how `ArrayList` is an implementation of the `List` interface

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`
  - Just because `ArrayList` can do all the same things `Stack` and `Queue` can, doesn't mean it's best for your problem

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

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For-Each Loop

- A new kind of loop!

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

- BUT, you cannot *modify* the data structure inside a for-each loop
  - You will get a `ConcurrentModificationException`
  - They are “read-only”

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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`