LEC 08

CSE 122

Sets; For-each loops; Iterators

Questions during Class?

Raise hand or send here

sli.do #cse122

BEFORE WE START

Chat with neighbors:

What is your go-to breakfast?

Music: 122 25sp Lecture Tunes

Instructor: Brett Wortzman and Adrian Salguero

TAs:

Andrew	Diya	Logan	Steven
Anya	Elizabeth	Mahima	Yang
Brittan	Ivory	Medha	
Carson	Jack	Minh	
Christopher	Jacob	Nicole	
Colin	Ken	Samuel	
Dalton	Kyle	Shivani	
Daniel	Leo	Sreshta	

Lecture Outline

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

Announcements

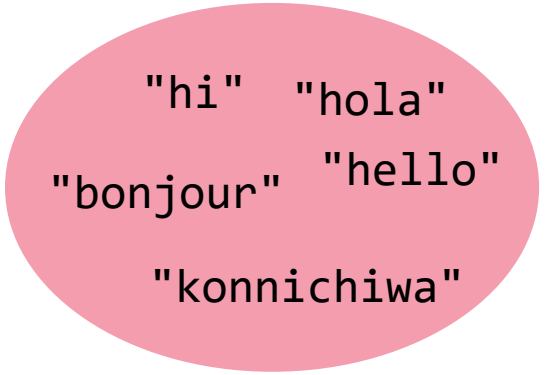
- Programming Assignment 1 (P1) due tomorrow!
  - Stacks, Queues, Exceptions
- Resubmission Cycle 1 was due yesterday
  - Remember that grades from a resubmission **completely replace** your previous grades for that assignment.
  - Resubmission Cycle 2 will open tomorrow
    - C0, P0, C1 eligible
- Heads up: Quiz 1 scheduled for Tuesday, May 13
  - Reference Semantics, Stacks, Queues, Sets, Maps
- Programming Assignment 2 released on Friday, May 2nd
  - Yes, two Programming Assignments in a row!
  - BUT, you have two weeks to complete this assignment

Lecture Outline

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

(PCM) Sets (ADT)

- A collection of unique values (no duplicates allowed) that can perform the following operations efficiently:
  - 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`

- `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]"`

Lecture Outline

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

Practice Problem:

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

Lecture Outline

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

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, `Sets` are not for you!
  - Efficiency
    - Different data structures are “good at” different things!

Lecture Outline

- Announcements
- Sets Review
- Practice Problem
- Tradeoffs with Different Data Structures
- **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 *modify* the data structure inside a for-each loop
  - You will get a `ConcurrentModificationException`
  - They are “read-only”

Practice : Think

sli.do #cse122

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

sli.do #cse122

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

Lecture Outline

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

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`