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 24wi Lecture Tunes

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TAs

Ailsa	Chaafen	Helena	Megana	Sahej
Alexander	Chloe	Jessie	Mia	Shivani
Ambika	Claire	Katharine	Minh	Smriti
Andy	Colin	Kavya	Nicolas	Steven
Arkita	Colton	Ken	Poojitha	Vinay
Atharva	Connor	Kyle	Rohini	Zane
Autumn	Elizabeth	Logan	Ronald	
Ayush	Hannah	Marcus	Rucha	

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
  - Resubmission Cycle 2 will open tomorrow
- Heads up: Quiz 1 scheduled for Tuesday, Feb 13
  - ArrayLists, Reference Semantics, Stacks and Queues, Sets, Maps
- How to Use the IPL
- Programming Assignment 2 released on Friday, Feb 2
  - 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 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]"`

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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, `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”

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

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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

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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`