LEC 02

ArrayList

ArrayList

Questions during Class?

Raise hand or send here

sli.do #cse122

BEFORE WE START

Talk to your neighbors:

Dogs or cats?

Instructors Tristan Huber & Hunter Schafer

TAs

Ambika	Evelyn	Poojitha
Andrew	Jacob	Rishi
Audrey	Jaylyn	Rucha
Autumn	Jin	Shivani
Ayush	Joe	Shreya
Ben	Kevin	Steven
Colton	Leon	Suhani
Di	Megana	Yijia
Eesha	Melissa	Ziao
Elizabeth	Mia	

Lecture Outline

- Announcements
- Code Quality Recap
- ArrayList Recap
- ArrayList Examples

Announcements

- P0 is out, due tomorrow @11:59pm
  - make sure you hit ‘mark’ at least once on Ed
- IPL is open!
- Java Review session last Monday
  - recording now available on calendar
  - Java Tutorial

Lecture Outline

- Announcements
- **Code Quality Recap**
- ArrayList Recap
- ArrayList Examples

Code Quality - Functional Decomposition

Goal: make our code more understandable to humans

- Subgoal: `main` is a concise summary of the program
- Subgoal: all operations in a method are related
- Subgoal: no trivial methods

Code Quality - Functional Decomposition

Example: Solution from Friday's lecture

Code Quality - Other

122 Code Quality Guide

which includes..

- naming conventions: variableNames, methodNames, ClassNames, CLASS_CONSTANTS
- consistent indentation
- when possible, avoid repeated/redundant code

Commenting

[122 Commenting Guide]

Header comment

Class comment - what does this class do?

Method comments - every method besides main

- behavior of the method, including
  - parameters
  - returned value (if any)
  - thrown exceptions (if any)

Lecture Outline

- Announcements
- Code Quality Recap
- **ArrayList Recap**
- ArrayList Examples

🎉 NEW DATA STRUCTURE DAY!! 🎉

ArrayList - What is it good for?

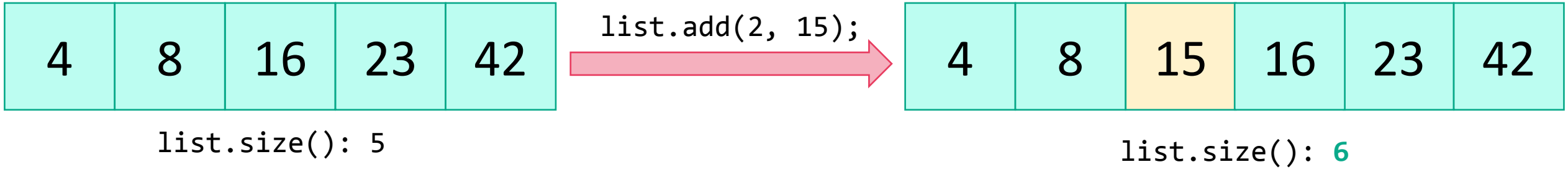
What is it?

- An **ordered, indexed** collection of elements
- All elements must be of same type*
- Dynamically sized (ie: add and remove elements w/out specifying an initial size)

What is it particularly good at?

- `get` elements by index (like an array)
- `set` elements at index (like an array)
- `add` new elements, as many as you want! (unlike an array)
- `add` & `remove` elements by index (unlike an array)

ArrayList - dynamic size



ArrayList Methods

Method	Description
`add(type element)`	Adds *`element`* to the end of the `ArrayList`
`add(int index, type element)`	Adds *`element`* to the specified *`index`* in the `ArrayList`
`size()`	Returns the number of elements in the `ArrayList`
`contains(type element)`	Returns `true` if *`element`* is contained in the `ArrayList`, `false` otherwise
`get(int index)`	Returns the element at *`index`* in the `ArrayList`
`remove(int index)`	Removes the element at *`index`* from the `ArrayList` and returns the removed element.
`indexOf(type element)`	Returns the index of *`element`* in the `ArrayList`; returns -1 if the *`element`* doesn't exist in the `ArrayList`
`set(int index, type element)`	Sets the element at *`index`* to the given *`element`* and returns the old value

Wrapper Types

```
int        =>  Integer
double     =>  Double
char       =>  Character
boolean    =>  Boolean
```

```
int[] list = new int[1];
list[0] = 3;
//  … is like …
ArrayList<Integer> list = new ArrayList<Integer>();
list.add(3);
```

Lecture Outline

- Announcements
- Code Quality Recap
- ArrayList Recap
- **ArrayList Examples**

ArrayList Construction Style

```
ArrayList<Double> list = new ArrayList<Double>();
```

```
ArrayList<Double> list = new ArrayList<>();
```

```
List<Double> list = new ArrayList<>();
```

Practice : Think

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How best to construct an ArrayList which stores characters?

A. `List<char> list = new ArrayList<char>();`

B. `ArrayList<Character> list = new ArrayList<Character>();`

C. `List<Character> list = new ArrayList<>();`

D. `ArrayList<> list = new ArrayList<Character>();`

Practice - reading ArrayList code

Practice : Think

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What is the best "plain English" description of this method?

```
public static void method(List<Double> list) {
    for (int i = 0; i < list.size(); i++) {
        System.out.println(" " + i + ":" + list.get(i));
    }
}
```

A) Prints stuff

B) Prints out the list from front to back, with elements numbered 0, 1, 2, …

C) Prints out the list from front to back

D) Prints out the list from back to front

E) Prints out the elements of the list using a for loop that starts at 0 and runs until one less than the size of the list and at each point prints out the element at that index.

Practice : Pair

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What is the best "plain English" description of this method?

```
public static void method(List<Double> list) {
    for (int i = 0; i < list.size(); i++) {
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A) Prints stuff

B) Prints out the list from front to back, with elements numbered 0, 1, 2, …

C) Prints out the list from front to back

D) Prints out the list from back to front

E) Prints out the elements of the list using a for loop that starts at 0 and runs until one less than the size of the list and at each point prints out the element at that index.

loadFromFile

Write a method called `loadFromFile` that accepts a `Scanner` as a parameter and returns a new `ArrayList` of `Strings` where each element of the `ArrayList` is a line from the `Scanner`, matching the order of the `Scanner`'s contents.

e.g., the first line in the `Scanner` is stored at index 0, the next line is stored at index 1, etc.

moveRight

Write a method called `moveRight` that accepts an `ArrayList` of integers `list` and an `int` n and moves the element at index n one space to the right in `list`.

For example, if `list` contains `[8, 4, 13, -7]` and our method is called with `moveRight(list, 2)`, after the method call `list` would contain `[8, 4, -7, 13]` (notice that the elements at indexes 2 and 3 have swapped places).

Practice : Think

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What ArrayList methods (and in what order) could we use to implement the moveRight method?

A)
```
list.remove(n);
list.add(n);
```

B)
```
int element = list.remove(n);
list.add(n, element);
```

C)
```
list.add(n);
list.remove(n-1);
```

D)
```
int element = list.remove(n);
list.add(n+1, element);
```

Practice : Pair

sli.do #cse122

What ArrayList methods (and in what order) could we use to implement the moveRight method?

A)
```
list.remove(n);
list.add(n);
```

B)
```
int element = list.remove(n);
list.add(n, element);
```

C)
```
list.add(n);
list.remove(n - 1);
```

D)
```
int element = list.remove(n);
list.add(n + 1, element);
```

Edge Cases! (And Testing)

When writing a method, especially one that takes input of some kind (e.g., parameters, user input, a Scanner with input) it's good to think carefully about what assumptions you can make (or cannot make) about this input.

Edge case: A scenario that is uncommon but possible, especially at the "edge" of a parameter's valid range.

❓ What happens if the user passes a negative number to `moveDown`?

❓ What happens if the user passes a number larger than the length of the list to `moveDown`?

More testing tips on the course website's Resources page!

compareToList

Write a method called `compareToList` that accepts two `ArrayLists` of integers `list1` and `list2` as parameters and compares the elements of the two lists, printing out the locations of common elements in each of the `ArrayLists`.

For example, if `list1` contained `[5, 6, 7, 8]` and `list2` contained `[7, 5, 9, 0, 2]`, a call to `compareToList(list1, list2)` would produce output such as:

```
- 5 (list1 at 0, list2 at 1)
- 7 (list1 at 2, list2 at 0)
```

Practice : Think

sli.do #cse122

Spend 1 min on your own thinking about how you would implement this method! (focus on *pseudocode*)

Write a method called `compareToList` that accepts two `ArrayLists` of integers `list1` and `list2` as parameters and compares the elements of the two lists, printing out the locations of common elements in each of the `ArrayLists`.

For example, if `list1` contained `[5, 6, 7, 8]` and `list2` contained `[7, 5, 9, 0, 2]`, a call to `compareToList(list1, list2)` would produce output such as:

```
- 5 (list1 at 0, list2 at 1)
- 7 (list1 at 2, list2 at 0)
```

Practice : Pair

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Spend 2 min discussing about how you would implement this method with a neighbor! (focus on *pseudocode*)

Write a method called `compareToList` that accepts two `ArrayLists` of integers `list1` and `list2` as parameters and compares the elements of the two lists, printing out the locations of common elements in each of the `ArrayLists`.

For example, if `list1` contained `[5, 6, 7, 8]` and `list2` contained `[7, 5, 9, 0, 2]`, a call to `compareToList(list1, list2)` would produce output such as:

```
- 5 (list1 at 0, list2 at 3)
- 7 (list1 at 2, list2 at 0)
```

ArrayList Methods

Method	Description
`add(type element)`	Adds *`element`* to the end of the `ArrayList`
`add(int index, type element)`	Adds *`element`* to the specified *`index`* in the `ArrayList`
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`get(int index)`	Returns the element at *`index`* in the `ArrayList`
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`indexOf(type element)`	Returns the index of *`element`* in the `ArrayList`; returns -1 if the *`element`* doesn't exist in the `ArrayList`
`set(int index, type element)`	Sets the element at *`index`* to the given *`element`* and returns the old value

topN

Write a method called `topN` that accepts an `ArrayList` of characters `list` and an `int` n and returns a new `ArrayList` of characters that contains the first n elements of list.

For example, if `list` contained `['g', 'u', 'm', 'b', 'a', 'l', 'l’]`, a call to `topN(list, 4)` would return an `ArrayList` containing `['g', 'u', 'm', 'b']`