CSSE 220 Day 10

Arrays, ArrayLists,
Wrapper Classes, Auto-boxing,
Enhanced *for* loop

Check out *ArraysAndLists* from SVN

Questions?

Exam Coming!

See the Schedule page, Session 12, for a link to a document that lists the topics covered by this exam

- Test Friday
  - In class but you may have up to 50 mins of extra time. You can work from at 7:10-8:00 am or any of hours 1-4 that you are free.
  - If you can't do it in one contiguous chunk, you can only leave between the two parts of the exam – plan accordingly.
- Topics from Chapters 1-7 will include:
  - A closed-book paper part: short answer, fill-in-the-blank, trace-code-by-hand, draw box-and-pointer diagrams, find-errors-in-code, write short chunks of code
    - We have listed ALL the possible topics for this portion of the exam
  - A programming part: 1-2 small programs, unit tests provided for some of them, you write unit tests for others
- Review in class Thursday
  - Bring questions
  - I won't prepare anything but am happy to cover whatever you want, including working examples

Q1

Array Types

- What it is for:
  - Bundling a collection of objects under a single name,
  - With elements in the collection referred to by their index in the collection (0, 1, 2, …)
- Syntax for declaring: *`ElementType[] name`*
- Examples:
  - A local variable: `double[] averages;`
  - Parameters: `public int max(int[] values) {…}`
  - A field: `private Investment[] mutualFunds;`

Allocating Arrays

- Syntax for allocating:

  new *ElementType***[***length***]**

- Creates space to hold values
- Sets values to defaults
  - **0** for number types
  - **false** for boolean type
  - **null** for object types
- Examples:
  - `double[] polls = new double[50];`
  - `int[] elecVotes = new int[50];`
  - `Dog[] dogs = new Dog[50];`

Don’t forget this step!

This does NOT construct any Dog’s. It just allocates space for referring to Dog’s (all the Dog’s start out as *null*)

Q2

Reading and Writing Array Elements

- Reading:
  - `double exp = polls[42] * elecVotes[42];`

Reads the element with index 42.

Sets the value in slot 37.

- Writing:
  - `elecVotes[37] = 11;`

- Index numbers run from 0 to array length – 1
- Getting array length: `elecVotes.length`

No parentheses, array length is (like) a field

Q3,4

Arrays: Comparison Shopping

Arrays…	Java	C	Python
have fixed length	yes	yes	no
are initialized to default values	yes	no	n/a
track their own length	yes	no	yes
trying to access “out of bounds” stops program before worse things happen	yes	no	yes

Live Coding

A mathematical inquiry into the Law of Large Numbers

– A simulation using dice

- Design

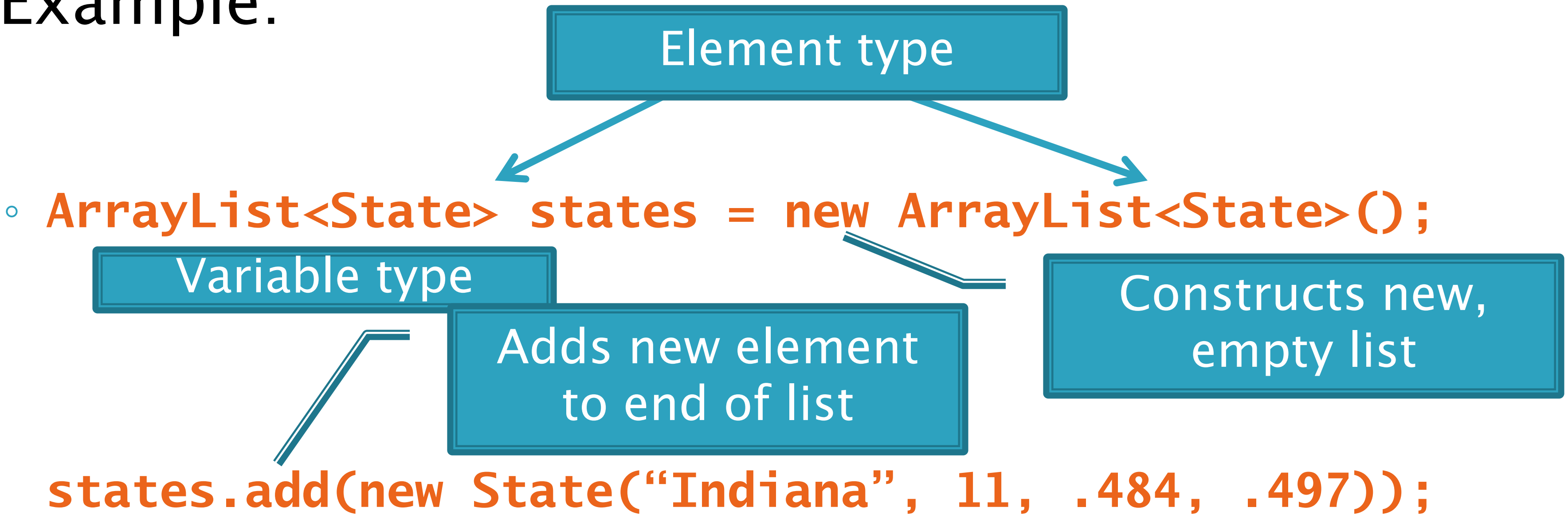
Implementation (together)

Begin the RollingDice program (in ArraysAndLists), per the instructions in Homework 10

You might find the Summary on Arrays and ArrayList's helpful.

What if we don’t know how many elements there will be?

- ArrayLists to the rescue
- Example:



Element type

```
ArrayList<State> states = new ArrayList<State>();
```

Variable type

Adds new element to end of list

Constructs new, empty list

```
states.add(new State(“Indiana”, 11, .484, .497));
```

- **ArrayList** is a *generic class*
  - Type in <brackets> is called a *type parameter*

Q5,6

ArrayList Gotchas

- Type parameter can’t be a primitive type
  - Not: `ArrayList<int> runs;`
  - But: `ArrayList<Integer> runs;`

- Use *get* method to read elements
  - Not: `runs[12]`
  - But: `runs.get(12)`

- Use **`size()`** not **`length`**
  - Not: `runs.length`
  - But: `runs.size()`

Lots of Ways to Add to List

- Add to end:
  - `victories.add(new WorldSeries(2008));`
- Overwrite existing element:
  - `victories.set(0,new WorldSeries(1907));`
- Insert in the middle:
  - `victories.add(1, new WorldSeries(1908));`
  - Pushes elements at indexes 2 and higher up one

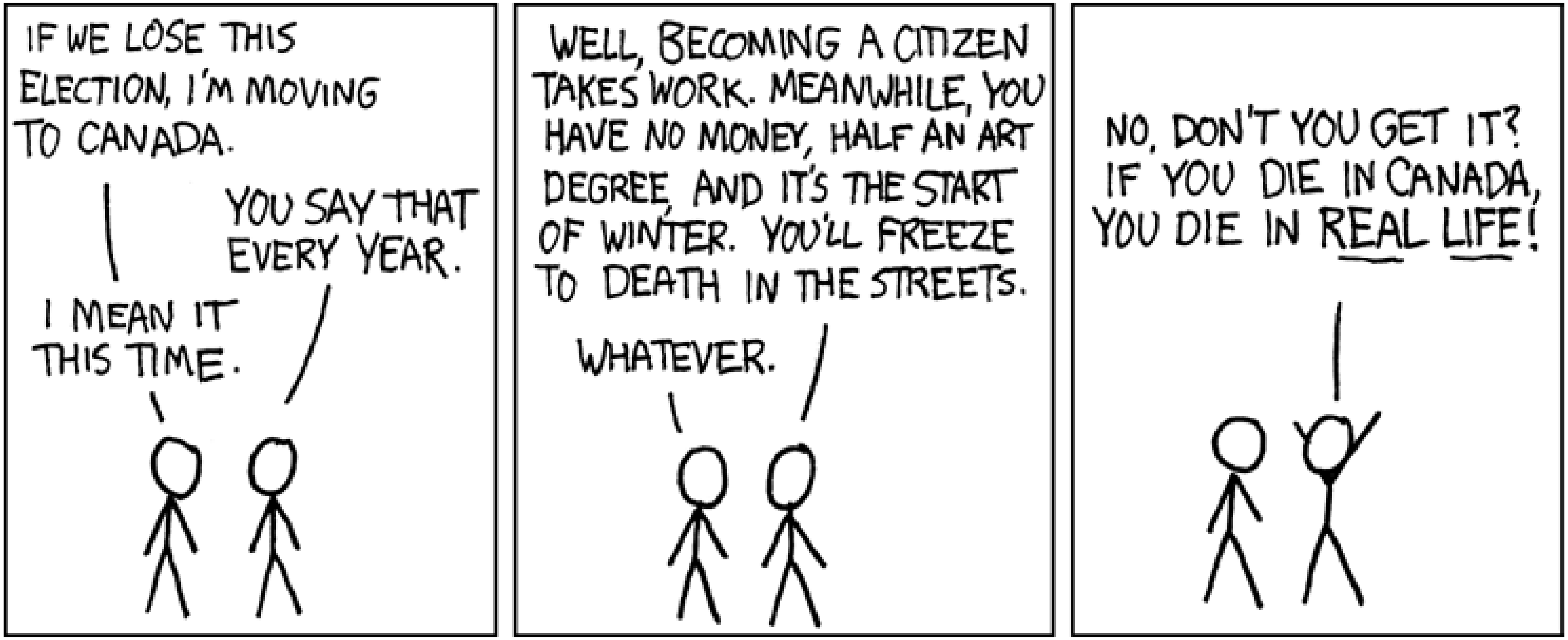
- Can also remove:
  - `victories.remove(victories.size()  - 1)`

Live Coding

- Continue the RollingDice program (in ArraysAndLists), per the instructions in Homework 10

  You might find the Summary on Arrays and ArrayList's helpful.

Cartoon of the Day


IF WE LOSE THIS ELECTION, I'M MOVING TO CANADA.
YOU SAY THAT EVERY YEAR.
I MEAN IT THIS TIME.
WELL, BECOMING A CITIZEN TAKES WORK. MEANWHILE, YOU HAVE NO MONEY, HALF AN ART DEGREE, AND IT'S THE START OF WINTER. YOU'LL FREEZE TO DEATH IN THE STREETS.
WHATEVER.
NO, DON'T YOU GET IT? IF YOU DIE IN CANADA, YOU DIE IN REAL LIFE!

IT'S ALL REAL!

So, what's the deal with primitive types?

- Problem:
  - ArrayList's only hold objects
  - Primitive types aren't objects
- Solution:
  - *Wrapper classes*—instances are used to "turn" primitive types into objects
  - Primitive value is stored in a field inside the object

Primitive	Wrapper
byte	Byte
boolean	Boolean
char	Character
double	Double
float	Float
int	Integer
long	Long
short	Short

Q7

Auto-boxing Makes Wrappers Easy

- Auto-boxing: automatically enclosing a primitive type in a wrapper object when needed
- Example:
  - You write: `Integer m = 6;`
  - Java does: `Integer m = new Integer(6);`

  - You write: `Integer answer = m * 7;`
  - Java does:

    ```
    int temp = m.intValue() * 7;
    Integer answer = new Integer(temp);
    ```

Auto-boxing Lets Us Use ArrayList’s with Primitive Types

- Just have to remember to use wrapper class for list element type

- Example:

  -
    ```
    ArrayList<Integer> runs =
           new ArrayList<Integer>();
    runs.add(9); // 9 is auto-boxed
    ```

  -
    ```
    int r = runs.get(0); // result is unboxed
    ```

Enhanced For Loop and Arrays

- Old school

```
double scores[] = …
double sum = 0.0;
for (int i=0; i < scores.length; i++) {
    sum += scores[i];
}
```

- New, whiz-bang, enhanced for loop

```
double scores[] = …
double sum = 0.0;
for (double score : scores) {
    sum += score;
}
```

Say "in"

- No index variable (**easy, but limited in 2 respects**)
- Gives a name (**score** here) to each element

Enhanced For and ArrayList’s

```
ArrayList<State> states = …
int total = 0;
for (State state : states) {
    total += state.getElectoralVotes();
}
```

Q8

Live Coding

TONIGHT, do the short Survey for assigning partners for the Game of Life exercise on Angel, under
 Lessons ~ Assessments
(at the top, first item listed)

Finish the RollingDice program (in ArraysAndLists), per the instructions in Homework 10

Then continue on HW 10.

You might find the Summary on Arrays and ArrayList's helpful.