CSSE 220 Day 8

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

Check out *ArraysAndLists* from SVN

Questions?

Exam 1 is October 1, 7-9 PM!

- Over chapters 1-7
- You'll have a chance to ask questions about anything in next Tuesday's class.
- See Session 10 on the Schedule Page schedule for **Exam 1 samples**

Part 1 – Written. You may bring an 8.5 x 11 inch sheet of paper (double-sided, hand-written or printed) with whatever you want on it.

Part 2 – Computer. Code that you must write and debug. You can use your textbook, the Java API documents, and any programs that you have written or we have given you.

Q1

Array Types

- Group a collection of objects under a single name
- Elements are referred to by their **position**, or ***index***, in the collection (0, 1, 2, …)
- Syntax for declaring: `ElementType[] name`
- Declaration 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 **Dogs**. It just allocates space for referring to **Dogs** (all the **Dogs** 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-Q4

Arrays: Comparison Shopping

Arrays...	Java	C	Python lists
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

- Investigating the Law of Large Numbers
  - A simulation using dice
- Design
- Implementation (together)
- Begin the **RollingDice** program for HW8 (in **ArraysAndLists project**)

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

- **ArrayLists** to the rescue
- Example:

Element type

Variable type

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

Constructs new, empty list

Adds new element to end of list

  -

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

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

Q5-Q6

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(2011));`
- Overwrite existing element:
  - `victories.set(0,new WorldSeries(1907));`
- Insert in the middle:
  - `victories.add(1, new WorldSeries(1908));`
  - Pushes elements at indexes 1 and higher up one

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

Continue **RollingDice**

LIVE CODING

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 ArrayLists 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

Finish **RollingDice**, then continue on HW 8.

LIVE CODING

Q9-Q10