Recitation 2

Main Method, API & Packages, Java Basics

Demo 1: Making an application

Create a new eclipse project
- Eclipse: File -> New -> Java Project
- File -> New -> Class
- Check the main method stub. Hit "Finish"
- Write inside main method stub:
  - `System.out.println("Hello World");`
- Hit the green play button

Main method

When you run your application, it starts by calling method main:

`public static void main(String[] args) { … }`

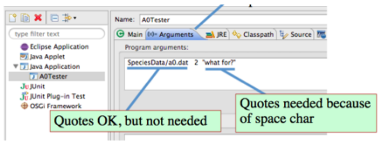
Accepts one parameter of type `String[]` (array of Strings)

Demo 2: Using program arguments

Now let's change the program to print out a user supplied argument!

Demo 2: Inputting program arguments

Now we'll tell Eclipse what arguments to use
- Run -> Run Configurations
- Click "Arguments" tab
- Enter arguments, and hit "Apply"



Name: A0Tester

Program arguments: SpeciesData/a0.dat 2 "what for?"

Exercise 1: Using program arguments

Write a program that prints whether a point is inside a circle. The program should receive 5 arguments in this order:
1. x coordinate of the point
2. y coordinate of the point
3. x coordinate of the circle's origin
4. y coordinate of the circle's origin
5. radius of the circle

Hints:
- Java arrays are 0-indexed
- `Double.parseDouble(str)` returns `str` as a `double`
- `Math.sqrt(d)`s returns the square root of `d`

Java API & Packages

Java API (Application Programming Interface)

- Java provides a number of useful classes and interfaces
- The Java API documents how to use these classes. Each API page contains:
  - class/interface hierarchy
  - **Overview**
  - fields
  - constructors
  - **Methods**
- http://docs.oracle.com/javase/8/docs/api/index.html
  - Also available on course website. Click the "Links" tab

most useful

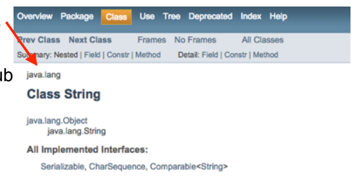
For fields, constructors, methods there is a Summary and a Detail

Demo 3: How to use Java API

- Let's make a program that takes a user supplied time (String) in the form of *hours:minutes* and prints out the hours and then the minutes.
- What class can help you with this?
  - Google search "Java 8 API <name of class>"
  - Click the docs.oracle.com link
  - Look for methods related to your task

Where did class String come from?

- Package java.lang
- Package: group of related classes
  - Can contain sub packages
- Why?
  - organization
  - namespace
  - encapsulation



java.lang

Class String

java.lang.Object
    java.lang.String

All Implemented Interfaces:

Serializable, CharSequence, Comparable<String>

Demo 4: java.lang is special

What happens when we try to use a class from a package other than java.lang?

- Make a method whose body is:
  - `JFrame frame = new JFrame();`
- Hover over the error and have Eclipse import the class
- Scroll to the top and see what the import statement looks like

Importing from other packages

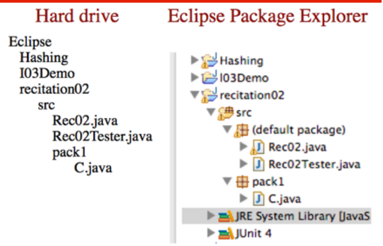
- `import javax.swing.JFrame;`
  - imports class JFrame from package javax.swing
- `import javax.swing.*;`
  - imports every class and interface from package javax.swing

Exercise 2: Random numbers

- Write a function that accepts two parameters of type double, and prints out a random double between those two numbers
- Hints:
  - You will need to import a class from the Java API
  - Use your intuition about what class to use, and search Google for it
  - Look over the class's methods to find one that can help you

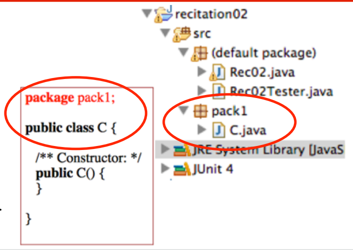
Custom packages

Except for the default package, file structure matches package structure



Custom packages (continued)

- Importing works the same as the Java API
- Except for the default package, classes must **declare** their package above the class header

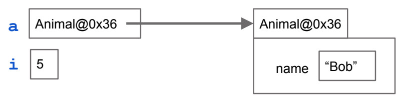


```
package pack1;

public class C {

  /** Constructor: */
  public C() {
  }

}
```

Java Basics

Primitive types vs classes

- Variable declarations:
  - `int i= 5;`
  - `Animal a= new Animal("Bob");`
- `Animal` and `int` are both types, but `Animal` is a class and `int` is a primitive type



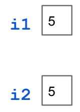
Demo 5: Primitive types vs classes

- instantiating primitive types
- how == behaves on primitives and objects

Demo explained

Variables with a primitive type contain their value directly:

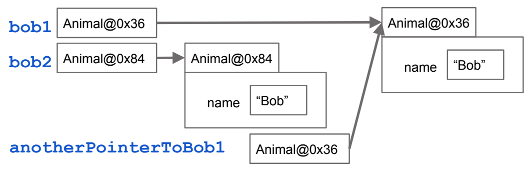
```
int i1= 5;

int i2= 5;
```



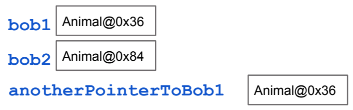
So `i1 == i2` translates to `5 == 5`
Variables with a class type contain a pointer to an object . . .

Demo explained

```
Animal bob1= new Animal("Bob");
Animal bob2= new Animal("Bob");
Animal anotherPointerToBob1= bob1;
```



Demo explained



So `bob1 == bob2` translates to
`Animal@0x36 == Animal@0x84`
While `bob1 == anotherPointerToBob1` translates to
`Animal@0x36 == Animal@0x36`

Class Character

class Character contains useful methods

- Examples of useful `Character` methods:
  - `Character.isDigit(c)`
  - `Character.isLetter(c)`
  - `Character.isWhitespace(c)`
  - `Character.isLowerCase(c)`
  - `Character.toLowerCase(c)`
  - see Java API for more!
- These methods are `static` and are applied to `char c`

Demo 6: chars

- Notice the characters beginning with a `\`. These are called escaped characters and have a special meaning
  - Examples: `'\n'` `'\t'` `'\"'` `'\''`
  - Google search "java tutorial escaped characters" to see all the escaped characters
- Character int values for letters and numbers are sequential
- `chars` can be compared by their int value.

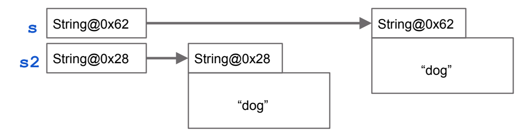
Strings: Special objects

- Strings are objects
- However:
  - They can be created with literals
  - They are immutable (unchangeable)

String literals

String instantiation:

- Constructor: `String s= new String("dog");`
- Literal: `String s2= "dog";`
- Roughly equivalent, but literal is preferred



Strings are immutable

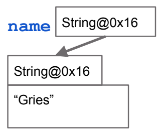
Once a String is created, it cannot be changed

- Methods such as `toLowerCase` and `substring` return new Strings, leaving the original one untouched
- In order to "modify" Strings, you instead construct a new String and then reassign it to the original variable:
  - `String name = "Gries";`
  - `name= name + ", ";`
  - `name= name + "David";`

Strings are immutable

What happens when you execute this?

- `String name= "Gries";`
- `name= name + ", ";`
- `name= name + "David";`



Strings are immutable

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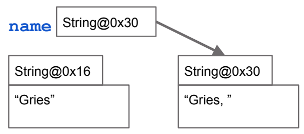

Strings are immutable

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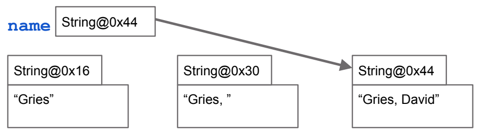

String concatenation

Operator + operator is called catenation, or concatenation

- If one operand is a String and the other isn't, the other is converted to a String
- Important case: Use `"" + exp` to convert `exp` to a String.
- Evaluates left to right. Common mistake:
  - `System.out.println("sum: " + 5 + 6);`
    - Prints `"sum: 56"`
  - `System.out.println("sum: " + (5 + 6));`
    - Prints `"sum: 11"`

Other String info

- Always use `equals` to compare Strings:
  - `str1.equals(str2)`
- Useful methods:
  - `length`, `substring`, `indexOf`, `charAt`, `lastIndexOf`, `split`, `trim`, `contains`, `compareTo`, `startsWith`, `endsWith`
- Look these up yourself in the Java API!

Key takeaways

1. The Java API is your best friend. **Google search** is a good way to find documentation on classes and methods.
   a. Other way to get to Java API: Course webpage, click “Link” in navigation bar, and click the Java API link.
2. Variables with a primitive type contain primitive values, those with a class type contain **names (pointers to)** to objects, like String@45afbc
3. Strings are **immutable** objects