Today’s topics

Java
  Syntax and Grammars
  Sample Programs
Upcoming
  More Java

Reading
  Great Ideas, Chapter 2
Java!

- Java is a buzzword-enabled language
- From Sun (the developers of Java),
  "Java is a simple, object-oriented, distributed, interpreted, robust, secure, architecture-neutral, portable, high performance, multi-threaded, and dynamic language."

- What do all of those terms mean?
“Java is a simple, object-oriented, distributed, interpreted, robust, secure, architecture-neutral, portable, high performance, multi-threaded, and dynamic language.”

- A programming language
  - A vocabulary and set of syntactical (grammatical) rules for instructing a computer to perform specific tasks
  - You can do most anything in any programming language
  - A particular language encourages one to do things in a certain way

- A Question for the course: Is this a fair characterization?
Based on popular languages called C and C++

- C: old, pretty bare bones language
- C++: newer, more complicated language
- Start from C and add some of C++’s more useful features
  - From Gosling, the creator, “Java omits many rarely used, poorly understood, confusing features of C++ that in our experience bring more grief than benefits.”

- Question: Is Java really all that simple?
The object-oriented paradigm

- Problems and their solutions are packaged in terms of classes
- The information in a class is the data
- The functionality in a class is the method
- A class provides the framework for building objects

Object-oriented programming (OOP) allows pieces of programs to be used in other contexts more easily.
“Java is a simple, object-oriented, **distributed**, interpreted, robust, secure, architecture-neutral, portable, high performance, multi-threaded, and dynamic language.”

- A distributed system is one where multiple separate computer systems are involved
  - Electronic card catalogs
  - The web

- Java was designed for the web
- Question: What are examples of a distributed task in your lives?
“Java is a simple, object-oriented, distributed, interpreted, robust, secure, architecture-neutral, portable, high performance, multi-threaded, and dynamic language.”

- Java a high-level language
- High-level languages must be translated to a computer’s native tongue, machine language
- Interpreted high-level languages are translated to an intermediate form and then carried out (run or executed) using an interpreter.
- Why?
- We’ll learn more about this later
“Java is a simple, object-oriented, distributed, interpreted, robust, secure, architecture-neutral, portable, high performance, multi-threaded, and dynamic language.”

- Programs will have errors, but a good program degrades reasonably
- A robust program may not do exactly what it is supposed to do, but it should not bring down other unrelated programs down with it
- Question: Give me an example of a non-robust program you have seen?
“Java is a simple, object-oriented, distributed, interpreted, robust, secure, architecture-neutral, portable, high performance, multi-threaded, and dynamic language.”

- Security: techniques that ensure that data stored on a computer cannot be read or compromised
- A program is running on your computer. What is to stop it from erasing all of your data, accidentally or otherwise?

- Question: Is Java really all that secure?
“Java is a simple, object-oriented, distributed, interpreted, robust, secure, architecture-neutral, portable, high performance, multi-threaded, and dynamic language.”

- A language is architecture-neutral if it does not prefer a particular type of computer architectures
- E.g. The Macintosh processor family (PowerPC) and the PC (x86-Pentium) family have their own respective strengths and weaknesses. It is not too hard to construct a program that will run faster on one than an other.

- A particular program is never entirely architecture neutral though
- Question: When is being architecturally neutral a bad thing?
“Java is a simple, object-oriented, distributed, interpreted, robust, secure, architecture-neutral, portable, high performance, multi-threaded, and dynamic language.”

- A program is portable if it will work the same (roughly) on many different computer systems
- HTML is also platform-independent or portable
- A whole lot of effort is currently spent porting non-portable code
“Java is a simple, object-oriented, distributed, interpreted, robust, secure, architecture-neutral, portable, high performance, multi-threaded, and dynamic language.”

- Performance: speed in completing some task
- Performance is everything to most computer and software manufacturers.

- Story:
  - If the transportation industry kept up with the computer industry, one would be able to now buy a Roll Royce that could drive across country in 5 minutes for $35.

- Rebuttal:
  - It would crash once a week, killing everyone on board.
“Java is a simple, object-oriented, distributed, interpreted, robust, secure, architecture-neutral, portable, high performance, multi-threaded, and dynamic language.”

- A thread is a part of the program that can operate independently of its other parts
- Multi-threaded programs can do multiple things at once
  ↗ e.g. download a file from the web while still looking at other web pages

- Question: What is the problem with multiple agents working at the same time?
  ↗ Synchronization
“Java is a simple, object-oriented, distributed, interpreted, robust, secure, architecture-neutral, portable, high performance, multi-threaded, and dynamic language.”

- Dynamic refers to actions that take place at the moment they are needed rather than in advance
  - Antonym: static
- A dynamic program can
  - Ask for more or less resources as it runs
  - Use the most recent version of some code that is available

- Question: Why is being dynamic a good thing?
A First Java Program

```java
import java.awt.*;
public class HelloWorld extends java.applet.Applet
{
    TextField m1, m2;
    public void init()
    {
        m1 = new TextField(60);
        m2 = new TextField(60);
        m1.SetText("Hello World");
        m2.SetText("This is a simple Java test.");
        add(m1);
        add(m2);
    }
}
```
Things to note:

- Program is a class
- Class contains *data* and *methods*
  - Methods also called *functions*
- Method `init()` always started for applets
- Add statements needed for *layout*
- Applet invoked through HTML file
- Program tested with Web browser or *appletviewer*
  - We will normally use our web pages
- Note points of grammar …
  - Semicolons, braces `{ }`, parentheses `()`, etc.
Sample file

• Can have separate web page:

```html
<HTML>
 <HEAD>
   <TITLE> The textfield demo program. </TITLE>
 </HEAD>
 <BODY>
 This tests the textfield capability.
 <APPLET code="HelloWorld.class" WIDTH=750 HEIGHT=325>
 </APPLET>
 </BODY>
</HTML>
```

• Or can incorporate the following line in any web page:

```html
<APPLET code="HelloWorld.class" WIDTH=750 HEIGHT=325> </APPLET>
```
Definitions

- **Algorithm**: ordered set of unambiguous executable steps, defining a terminating process
- **Program**: instructions executed by a computer
- **Applet**: Java program that is executed in a program such as appletviewer or a Java-enabled web browser
- **Class**: family of components sharing common characteristics consisting of:
  - **Data**: information
  - **Method**: functionality
- **Object**: instance of a class
- **Variable**: represent value stored in computer memory. A variable must be defined or declared before being used
  - Sometimes synonymous with object
Reflect on our progress

- What good is HelloWorld?
  - What have we accomplished?
  - Can link to our web page.
- Want something more.
  - Programs should do something for us.
  - Just putting a message on the screen is pretty lame ...
- Program results need to change as a result of:
  1. Our actions
  2. Other outside data
Decision trees

- If-Then statements
  
  ```java
  if (logical expression)
  {
    "true" actions
  }
  ```

- If-Then-Else statements
  
  ```java
  if (logical expression)
  {
    "true" actions
  }
  else (logical expression 2)
  {
    "false" actions
  }
  ```

- Logical expressions
  
  - analogous to yes or no questions
    
    - true or false

  - Statements that are true
    
    - (5 < 7)
    - (100 == 100)
    - (100 != 10)
    - (10 <= 10)

  - Statements that are false
    
    - (-2 > -1)
    - (10 != 10)
Using Buttons with if statements

- What does it mean to have an interactive program?
  - Computer must be waiting for your actions.
  - Like waiting for the phone to ring for an important call
  - Need something called a “listener”

- Also need to create Buttons
  - Example will show how

- With multiple Buttons, need to know which one was pressed
  - Like having different tone for front and back door bell
public class TrafficLight extends Applet implements ActionListener {

    TextField m1, m2;
    Button b1, b2, b3;
    public void init () {
        m1 = new TextField(80);
        m1.setText
            ("What are you going to do when the light is:");
        b1 = new Button("GREEN");
        b2 = new Button("YELLOW");
        b3 = new Button("RED");
        m2 = new TextField(80);
        add(m1); add(b1); add(b2); add(b3); add(m2);
Program using Buttons: 2

```java
b1.addActionListener(this);
b2.addActionListener(this);
b3.addActionListener(this);
}
```

- Have Invoked the listener with statements above
  - We have “told” the listener about each of the 3 buttons
- Now: Need to write the listener
  - Listener must be called `actionPerformed`
  - Using if statements, it will figure out which button was pushed and take the desired action
public void actionPerformed(ActionEvent event) {
    Object cause = event.getSource();
    if (cause == b1)
    {
        m2.setText("Keep on rolling.");
    }
    if (cause == b2)
    {
        m2.setText("Step on it! You can make it!");
    }
    if (cause == b3)
    {
        m2.setText("I suppose you'll have to stop.");
    }
}
A decision tree

Would you like to read about a scientist?

Would you like to read about Einstein?

He received the Physics Prize in 1921.

Try the Medicine Prize in 1962.

Look up the Peace Prize in 1991.

Try A. Solzhenitsyn, Literature 1970.
More Java Syntax

- Assignment statement
  \[ \text{variable} = \text{expression}; \]

- Method invocation
  - Also called function or procedure
  - Invoking also called “calling” a function
  - Methods can take arguments
    button.setText(“This text is an argument”);
    init();

- Variable declaration
  \[ \text{VariableType} \ \text{variableName}; \]
  Button choice;