CMSC 131
Object-Oriented Programming I

Libraries, Round Off Errors

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This material is based on material provided by Ben Bederson, Bonnie Dorr, Fawzi Emad, David Mount, Jan Plane
Overview

- Floating Point Calculations
- Libraries
- Java API
A general comment at the top of every class

A detailed comment above each method (describing the "contract" for the method... pre-conditions, post-conditions, etc.)

For MANY variables, a comment should appear near the declaration

Frequently comments should be embedded in the midst of complex code fragments to guide the reader about what is going on

As already mentioned avoid code duplication
Floating Point Calculations

What will this print?

```java
public class SimpleMath {
    public static void main(String[] args) {
        if (3.9 - 3.8 == 0.1) {
            System.out.println("I am a very smart computer.");
        } else {
            System.out.println("I can't do simple arithmetic.");
        }
    }
}
```

- What is the output?
- Floating point numbers in Java are stored in binary representation, and frequently numbers that are easily represented in base 10 cannot be represented precisely in base 2
- What can we do?
Two important rules:

- You can never use `==` to compare floating point values. Instead, check if two numbers are within a certain tolerance of each other.
  - `Math.abs((3.9 - 3.8) - 0.1) < EPSILON`

- Never use floating point values to represent money, e.g., 3.52 to represent $3.52. Instead, use integer 352 to represent 352 pennies.
Library → implementation of useful routines that are shared by different programs

Java mechanism for creating libraries: **packages**
- Package: group of related classes
- Example: `java.util` (contains `Scanner` class)

To create a package in Eclipse use
- File → New → Package

To use a class from a package, you can use a **fully qualified name** (package name + class name):
  ```java
  java.util.Scanner s = new java.util.Scanner(System.in);
  ```

You can also import the class in the beginning of the file
  ```java
  import java.util.Scanner;
  ```

To import class in a package:
  ```java
  import java.util.*;
  ```
  (Imports `Scanner` as well as other classes in package)
Package java.lang

- A special package containing widely used classes:
  - String
  - Math
  - etc.
- java.lang.* is automatically imported by every Java program
A class can be added to a package by including:

```
package <name of package>;
```

in source file (usually very first line)

- The variables / methods provided by a class / package are often called its **API** (= Application Programmers Interface)
- APIs should be documented
- java.lang documentation:
- We can use the javadoc utility to generate API documentation. Let’s generate example for some code we have written
String API & Math API

Java API
- [http://download.oracle.com/javase/6/docs/api/](http://download.oracle.com/javase/6/docs/api/)
- You should have this in your bookmarks
- You can even download it to your computer
- Extremely helpful

String API
- [http://download.oracle.com/javase/6/docs/api/index.html](http://download.oracle.com/javase/6/docs/api/index.html)
- Implements lots of string functions

Math API
- [http://download.oracle.com/javase/6/docs/api/index.html](http://download.oracle.com/javase/6/docs/api/index.html)
- Implements lots of Math functions