CS206 Intro to Data Structures

Java Basics

Administrivia

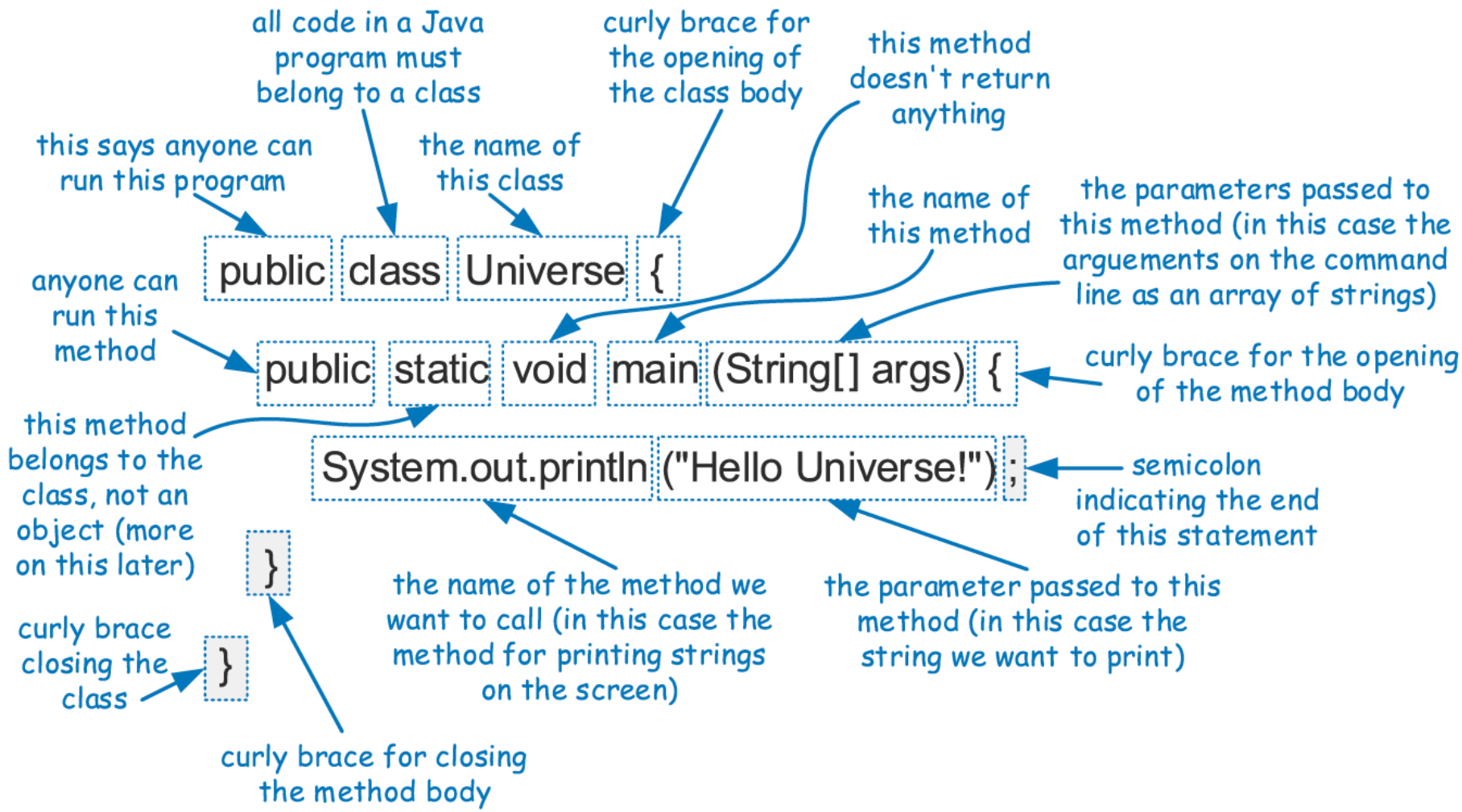
- Course website
  - www.cs.brynmawr.edu/cs206
  - Homeworks
    - Approximately weekly.
    - Typically due on Thursday before midnight
    - Help in lab Sunday-Thursday evenings
      - starting next week
  - Syllabus
    - Subject to change

More Administrivia

- CS account
  - If you do not have a cs account, sign up sheet
  - If you do, make sure you can log in
- Lab: Park 231/TH 2:25pm-3:45pm
- Lab attendance is required.
  - Complete labs before starting assignments
- Software: Java and Eclipse

What is a Data Structure?

An Example Program



Components of a Java Program

- Name of main class and file must agree
  - `class Main` <--> `Main.java`
- Statements are placed in methods, that belong to class definitions.
- The static method named `main` is the first method to be executed when running a Java program.
- Any set of statements between the braces `{` and `}` define a program block.

Base/Primitive Types

- Variables must have types
- Primitive types define memory used to store the data

boolean	a boolean value: true or false
char	16-bit Unicode character
byte	8-bit signed two's complement integer
short	16-bit signed two's complement integer
int	32-bit signed two's complement integer
long	64-bit signed two's complement integer
float	32-bit floating-point number (IEEE 754-1985)
double	64-bit floating-point number (IEEE 754-1985)

```
boolean flag = true;
boolean verbose, debug;
char grade = 'A';
byte b = 12;
short s = 24;
int i, j, k = 257;
long l = 890L;
float pi = 3.1416F;
double e = 2.71828, a = 6.022e23;
```

2s complement integers

the 2s complement of an N-bit number is defined as its complement with respect to 2^N. For instance, for the three-bit number 010, the two's complement is 110, because $010 + 110 = 1000$. The two's complement is calculated by inverting the digits and adding one

Value	Binary	Complement	2s Complement
0	000	111	000
1	001	100	111
2	010	101	110
3	011	100	101
-4	100	011	100
-3	101	010	011
-2	110	001	010
-1	111	000	001

Notes: leftmost bit is for sign in “Binary” column

Classes and Objects

- Every object is an instance of a class
- A class is a blueprint of what an object stores and how it functions
  - instance variables
  - methods
- Every variable is either a base type or a reference to an object

Creating and Using Objects

- In Java, a new object is created by using the `new` operator followed by a call to a constructor for the desired class.
- A constructor is a method that always shares the same name as its class. The new operator returns a reference to the newly created instance.
- Almost everything in Java is a class

Class Example

```
public class Counter {
  private int count;                                  // a simple integer instance variable
  public Counter( ) { }                               // default constructor (count is 0)
  public Counter(int initial) { count = initial; }    // an alternate constructor
  public int getCount( ) { return count; }            // an accessor method
  public void increment( ) { count++; }               // an update method
  public void increment(int delta) { count += delta; }// an update method
  public void reset( ) { count = 0; }                 // an update method
}
```

- instance variable
- methods
  - constructor
  - accessor

Continued Example

```
public static void main(String[] args)
{
        Counter c;
        c = new Counter();
        c.increment();
        c.increment();
        System.out.println(c.getCount());
        c.reset();
        Counter d = new Counter(5);
        d.increment();
        Counter e = d;
        e.increment();
        System.out.println(c.getCount() + " " + d.getCount() + " " +
        e.getCount());
}
```

Access Control Modifiers

- `public` designates that all classes may access
- `private` designates that access is granted only to code within that class.
- "" only classes within the package can access (I hate significant whitespace)
  - The package is generally the code you are working on.
  - e.g., `System.out` is a package

Static

- When a variable or method of a class is declared as `static`, it is associated with the class as a whole, rather than with each individual instance of that class.
- HH & HW example
- final
  - Variable
    - paired with static: set in class
    - not static: set in class or in every constructor
  - Method
    - Cannot be modified in subclasses

javadoc comments

- Comments
  - /* */
  - //
- A style/format of commenting for auto-generation of documentation in html

  /**

  */
  - used for method headers and classes

Example

```
/**
 * returns the sum of two integers
 * @param x The first integer
 * @param y The second integer
 * @return int The sum of x+y
 */
int sum(int x, int y)
```

Casting

- Assignment REQUIRES equal type
- Cast to change type

```
int x = 5;
double y = 1.2;
y = x;
x = y;
y = (double) x;
x = (int) y;
y = (double) x;
```

Implicit/Explicit Casting

- Widening cast – from a smaller/narrower type to a larger/wider - upcast
- Narrowing cast – the other way - downcast
- Java will perform an implicit cast when a widening is required, but not a narrowing
- Narrowing cast must be explicit