6.092: Introduction to Java

1: Types, Variables, Operators
Goal

Learn enough Java to do something useful

Examples:
- Simulate a natural/engineering process
- Manipulate PDFs
- Draw pretty graphics
Assignments

• View and submit via Stellar
• Due at 3 PM the next day (24 hours)
• Collaborate with others
• Write your own code
• Must submit first assignment

Must submit a “reasonable” attempt for 6/7 assignments to pass
The Computer

- Memory
- Central Processing Unit (CPU)
- Input/Output (IO) Devices
CPU Instructions

\[ z = x + y \]

Read location \( x \)
Read location \( y \)
Add
Write to location \( z \)
Programming Languages

• Easier to understand than CPU instructions
• Needs to be translated for the CPU to understand it
Java

- “Most popular” language
- Runs on a “virtual machine” (JVM)
- More complex than some (eg. Python)
- Simpler than others (eg. C++)
Compiling Java

Source Code (.java) → javac → Byte Code (.class) → java
First Program

class Hello {
    public static void main(String[] arguments) {
        // Program execution begins here
        System.out.println("Hello world.");
    }
}

Program Structure

class CLASSNAME {
    public static void main(String[] arguments) {
        STATEMENTS
    }
}
Output

System.out.println(some String) outputs to the console

Example:
    System.out.println("output");
class Hello2 {
    public static void main(String[] arguments) {
        System.out.println("Hello world.");  // Print once
        System.out.println("Line number 2");  // Again!
    }
}
Types

Kinds of values that can be stored and manipulated.

**boolean**: Truth value (true or false).
**int**: Integer (0, 1, -47).
**double**: Real number (3.14, 1.0, -2.1).
**String**: Text (“hello”, “example”).
Variables

Named location that stores a value of one particular type.

Form:

\[ TYPE \ NAME; \]

Example:

String foo;
Assignment

Use = to give variables a value.

Example:

```java
String foo;
foo = "IAP 6.092";
```
Assignment

Can be combined with a variable declaration.

Example:

double badPi = 3.14;
boolean isJanuary = true;
```java
class Hello3 {
    public static void main(String[] arguments) {
        String foo = "IAP 6.092";
        System.out.println(foo);
        foo = "Something else";
        System.out.println(foo);
    }
}
```
Operators

Symbols that perform simple computations

Assignment: =
Addition: +
Subtraction: -
Multiplication: *
Division: /
Order of Operations

Follows standard math rules:

1. Parentheses
2. Multiplication and division
3. Addition and subtraction
class DoMath {
    public static void main(String[] arguments) {
        double score = 1.0 + 2.0 * 3.0;
        System.out.println(score);
        score = score / 2.0;
        System.out.println(score);
    }
}
```java
class DoMath2 {
    public static void main(String[] arguments) {
        double score = 1.0 + 2.0 * 3.0;
        System.out.println(score);
        double copy = score;
        copy = copy / 2.0;
        System.out.println(copy);
        System.out.println(score);
    }
}
```
String Concatenation (+)

String text = "hello" + " world";
text = text + " number " + 5;
// text = "hello world number 5"
Assignment: GravityCalculator

Compute the position of a falling object:

\[ x(t) = 0.5 \times at^2 + v_i t + x_i \]