1: Types, Variables, Operators

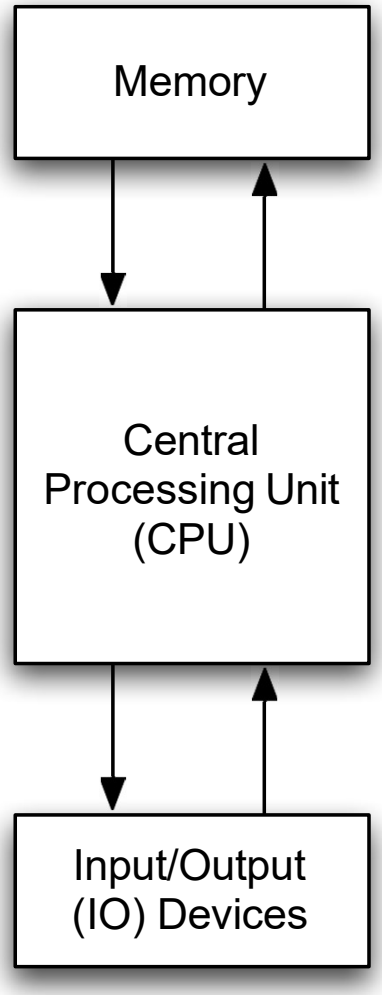
Goal

Learn enough Java to do something useful

Examples:

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

The Computer



CPU Instructions

z = x + y

Read location x

Read location y

Add

Write to location z

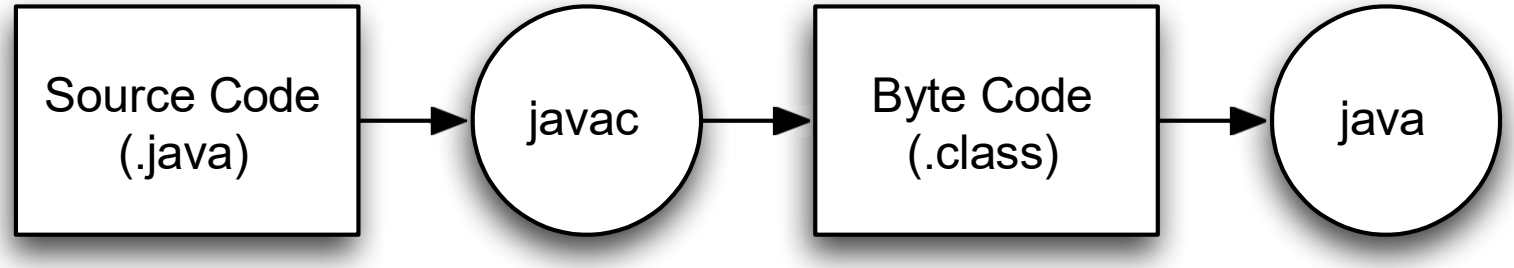
Programming Languages

- 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



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");
```

Second Program

```
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:

```
String foo;
foo = “IAP 6.092”;
```

Assignment

Can be combined with a variable declaration.

Example:

```
double badPi = 3.14;
boolean isJanuary = true;
```

```
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);
    }
}
```

```
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:

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