Object Oriented Programming

#2 Variable, Operation, Data Type

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Who is he?

Hello Java

```
public class HelloPrinter
{
   public static void main(String[] args)
   {
      System.out.println("Hello, World!");
   }
}
```

Compile Java Code

Programmers Problem

Programmers spend a fair amount of time fixing compile-time and run-time errors.

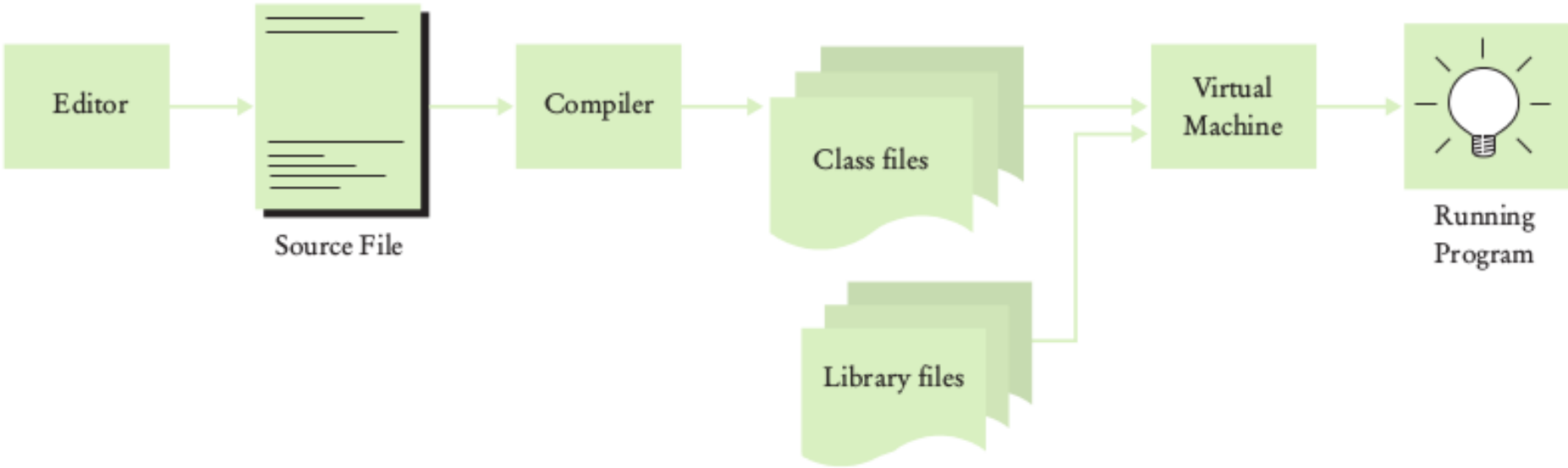
Why Programming

Finding the perfect partner is not a problem that a computer can solve.

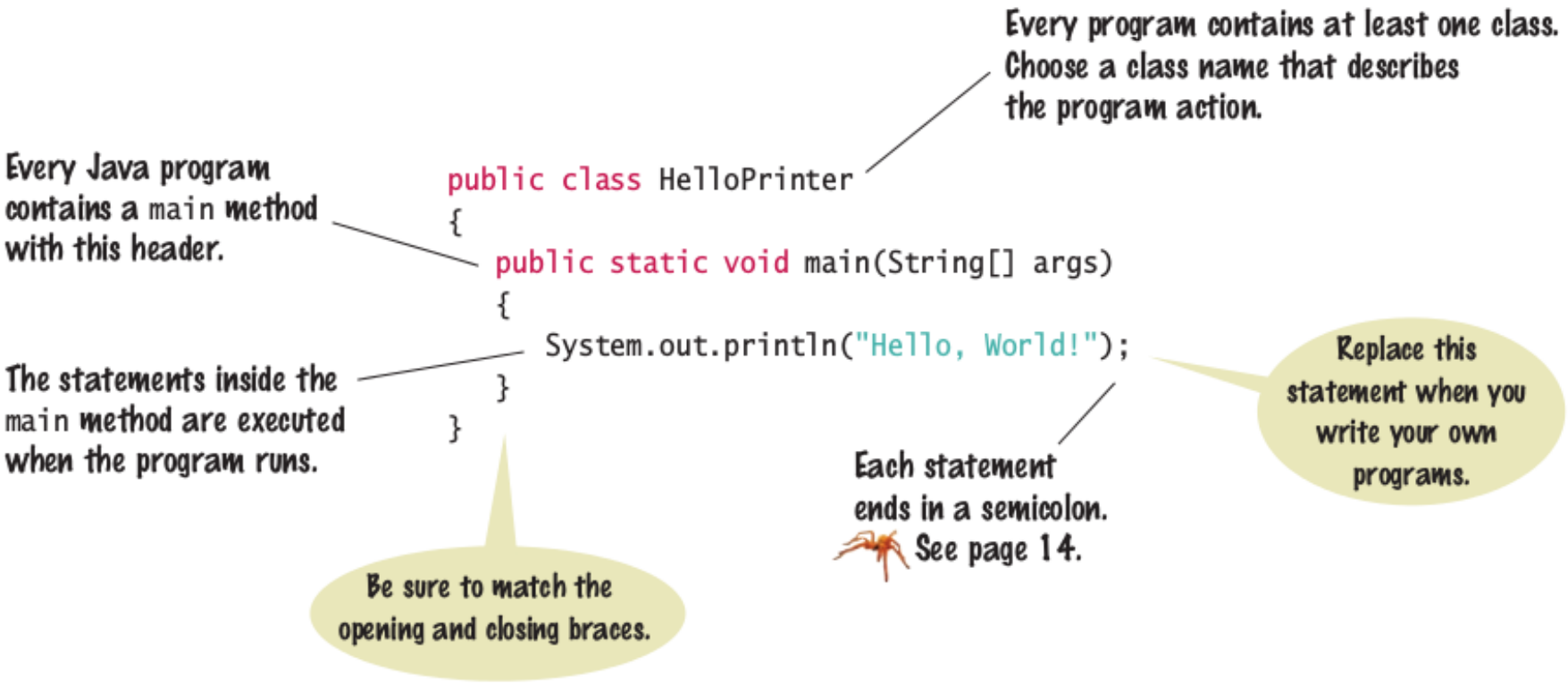
Your code?

- program vs. script
- source code vs. binary
- compiler?

Java application



Java structure



Definition

- What is variable?
- In programming, a variable is a value that can change, depending on conditions or on information passed to the program. Typically, a program consists of instructions that tell the computer what to do and data that the program uses when it is running.

Basic Type

Table 1 Primitive Types

Type	Description	Size
`int`	The integer type, with range –2,147,483,648 (`Integer.MIN_VALUE`) . . . 2,147,483,647 (`Integer.MAX_VALUE`, about 2.14 billion)	4 bytes
`byte`	The type describing a single byte, with range –128 . . . 127	1 byte
`short`	The short integer type, with range –32,768 . . . 32,767	2 bytes
`long`	The long integer type, with range –9,223,372,036,854,775,808 . . . 9,223,372,036,854,775,807	8 bytes
`double`	The double-precision floating-point type, with a range of about $\pm 10^{308}$ and about 15 significant decimal digits	8 bytes
`float`	The single-precision floating-point type, with a range of about $\pm 10^{38}$ and about 7 significant decimal digits	4 bytes
`char`	The character type, representing code units in the Unicode encoding scheme (see Computing & Society 4.2 on page 163)	2 bytes
`boolean`	The type with the two truth values `false` and `true` (see Chapter 5)	1 bit

Literal

Java Literals are syntactic representations of boolean, character, numeric, or string data. Literals provide a means of expressing specific values in your program.

Table 2 Number Literals in Java

Number	Type	Comment
6	int	An integer has no fractional part.
-6	int	Integers can be negative.
0	int	Zero is an integer.
0.5	double	A number with a fractional part has type double.
1.0	double	An integer with a fractional part .0 has type double.
1E6	double	A number in exponential notation: 1×10^6 or 1000000. Numbers in exponential notation always have type double.
2.96E-2	double	Negative exponent: $2.96 \times 10^{-2} = 2.96 / 100 = 0.0296$
100,000		**Error:** Do not use a comma as a decimal separator.
3 1/2		**Error:** Do not use fractions; use decimal notation: 3.5

Changing type

```
int dollars = 100;
double balance = dollars; // OK

double balance = 13.75;
int dollars = balance; // Error
```

Casting

```
double balance = total + tax;
int dollars = (int) balance;
```

Magic Number

```
h = 31 * h + ch;
```

Magic number problem

```
payment = dollars + quarters * 0.25 + dimes * 0.1
        + nickels * 0.05 + pennies * 0.01;
```

Solution

```
double quarterValue = 0.25;
double dimeValue = 0.1;
double nickelValue = 0.05;
double pennyValue = 0.01;

payment = dollars + quarters * quarterValue + dimes * dimeValue
      + nickels * nickelValue + pennies * pennyValue;
```

Better Way

```
final double QUARTER_VALUE = 0.25;
final double DIME_VALUE = 0.1;
final double NICKEL_VALUE = 0.05;
final double PENNY_VALUE = 0.01;
payment = dollars + quarters * QUARTER_VALUE + dimes * DIME_VALUE
      + nickels * NICKEL_VALUE + pennies * PENNY_VALUE;
```

Variable operation

Table 5 Arithmetic Expressions

Mathematical Expression	Java Expression	Comments
$\frac{x+y}{2}$	`(x + y) / 2`	The parentheses are required; `x + y / 2` computes $x + \frac{y}{2}$.
$\frac{xy}{2}$	`x * y / 2`	Parentheses are not required; operators with the same precedence are evaluated left to right.
$\left(1+\frac{r}{100}\right)^n$	`Math.pow(1 + r / 100, n)`	Use `Math.pow(x, n)` to compute x^n.
$\sqrt{a^2+b^2}$	`Math.sqrt(a * a + b * b)`	`a * a` is simpler than `Math.pow(a, 2)`.
$\frac{i+j+k}{3}$	`(i + j + k) / 3.0`	If i, j, and k are integers, using a denominator of 3.0 forces floating-point division.
π	`Math.PI`	`Math.PI` is a constant declared in the `Math` class.