



# I: Types, Variables, Operators

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Learn enough Java to do something useful

Examples:

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

The logo for 'Cartagena99' features the text 'Cartagena99' in a stylized, green, serif font, with a blue and orange gradient background behind the letters.

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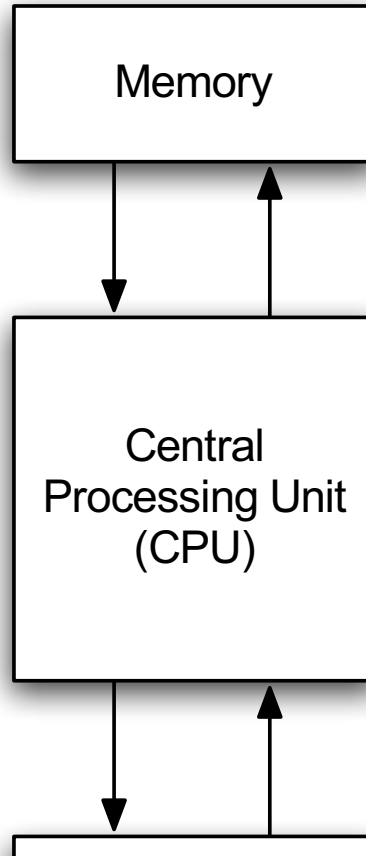
- View and submit via Codeboard.io
- Collaborate with others
- Write your **own** code
- Must submit every assignment

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$z = x + y$

Read location x

Read location y

Add

Write to location z

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

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

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## What is Java

- Object Oriented programming language from the 90s
- A programming tool developed by 13 people managed by James Gosling for the \*7 project
- Syntactically similar to C/C++ but much more simple
- Platform independent: "write once, run anywhere"
- Oak → Green → Java



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## Java history

- Java 1.0 - 1995
- Java 1.1 - 1997
- Java 1.2 - 1998 (Playground) → Java 2
- Java 1.3 - 2000 (Kestrel)
- Java 1.4 - 2002 (Merlín)
- Java 1.5 - 2004, (Tiger) → Java 5
- Java 1.6.0 - 2006, (Mustang) → Java 6



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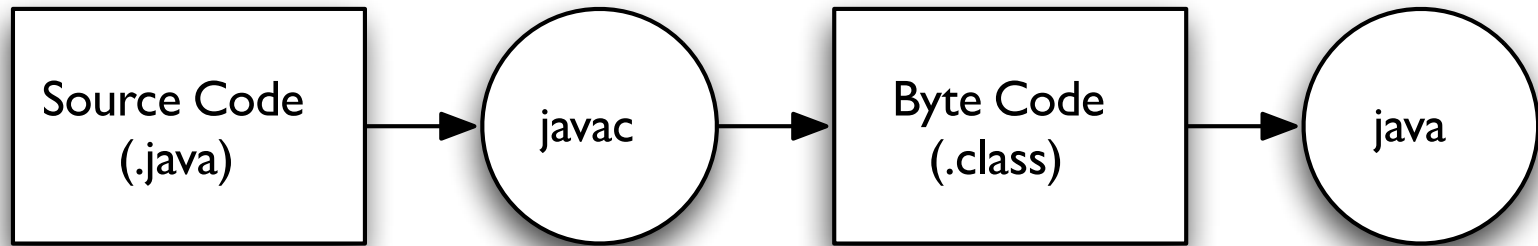
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## Java Virtual Machine



– A JVM is needed to run a Java program

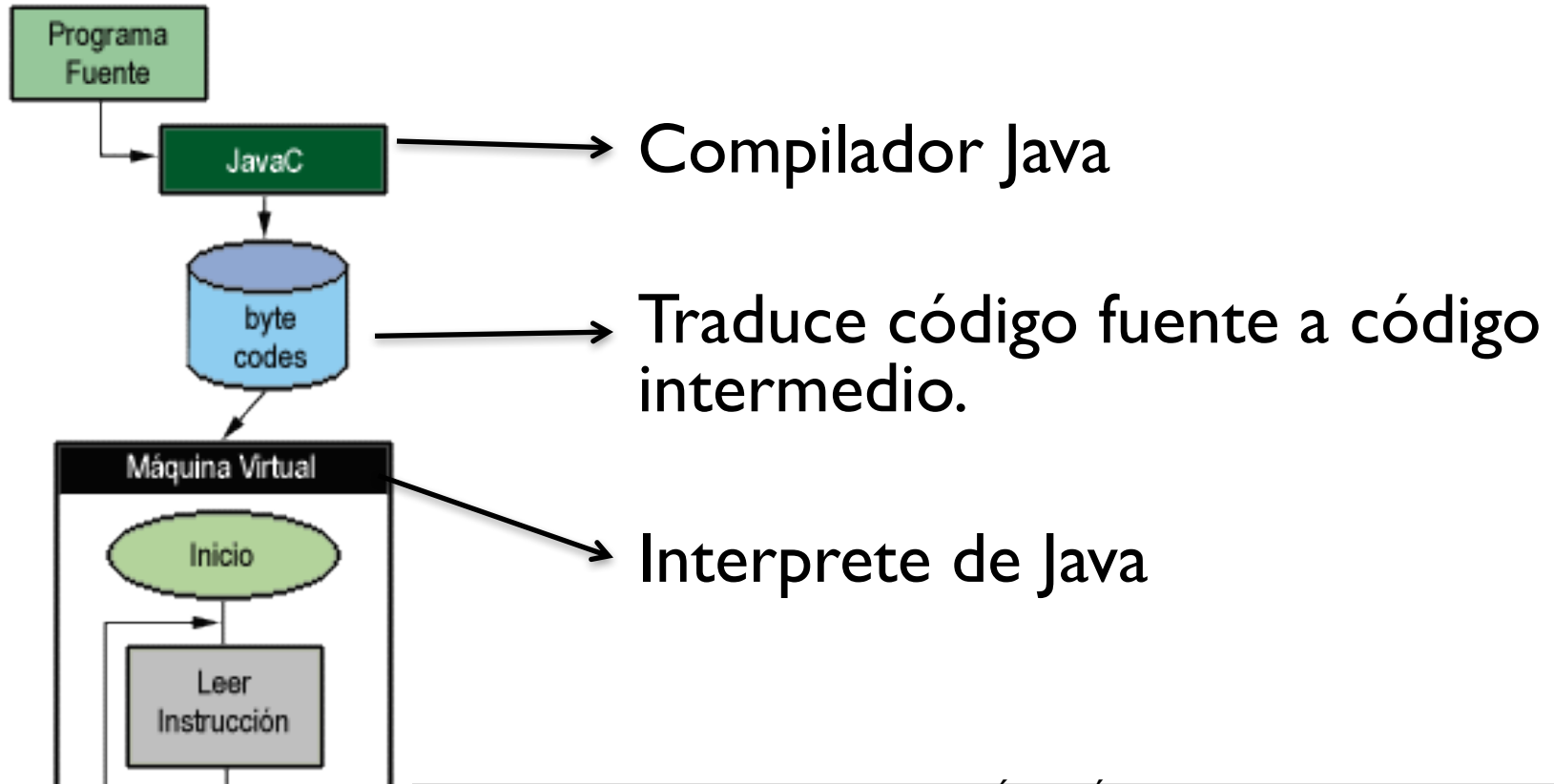


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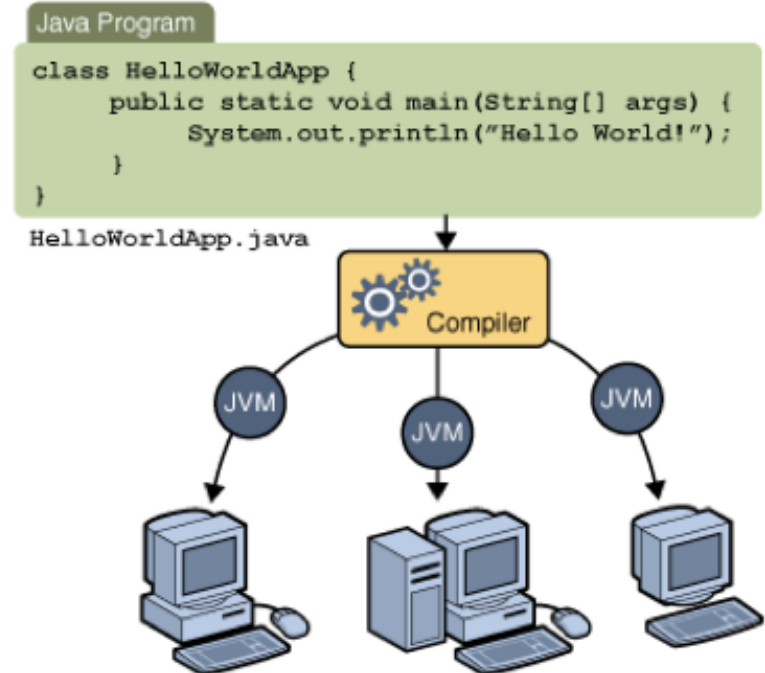
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## Bytecode

- Native language for any JVM.
- A Java program runs in any platform



Write once,  
run anywhere

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

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

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

Example:

– `System.out.println("output");`

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

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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”).

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Named location that stores a value of one particular type.

- Form:
  - **TYPE NAME;**
- Example

```
String foo;
```

Start with lower case and use an upper case for every new “word”



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Use = to give variables a value.

- Computes right part of the assignment and assigns the result to the variable on the left

Example:

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

foo

foo

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Can be combined with a variable declaration.

## Example

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

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```
class Hello3 {  
    public static void main(String[] arguments)  
    {  
        String foo = "IAP 6.092";  
        System.out.println(foo);  
        foo = "Something else";  
        System.out.println(foo);  
    }  
}
```

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## Symbols that perform simple computations

### – Simple arithmetic

Operador	Descripción	Ejemplo de expresión	Resultado del ejemplo
-	operador unario de cambio de signo	-4	-4
+	Suma	2.5 + 7.1	9.6
-	Resta	235.6 - 103.5	132.1
*	Producto	1.2 * 1.1	1.32
/	División (tanto entera como real)	0.050 / 0.2 7 / 2	0.25 3
%	Resto de la división entera	20 % 7	6

### – Combined arithmetic

Operador	Descripción	Ejemplo de expresión	Resultado del ejemplo
%=	Resto combinado	a%=b	a=a%b

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## The + operator is overridden

- Conventional add operator when used with numbers
- String concatenation when used with Strings

```
int a = 3;
int b = 2;
int c = a + b;
// c = 5
String text = a + "000" + b;
// text = "30002"
System.out.println(c);
```

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Relational

Operador	Descripción	Ejemplo de expresión	Resultado del ejemplo
==	igual que	7 == 38	false
!=	distinto que	'a' != 'k'	true
<	menor que	'G' < 'B'	false
>	mayor que	'b' > 'a'	true
<=	menor o igual que	7.5 <= 7.38	false
>=	mayor o igual que	38 >= 7	true

Logical

Operador	Descripción	Ejemplo de expresión	Resultado del ejemplo
!	Negación - NOT (unario)	!false !(5==5)	true false
	Suma lógica – OR (binario)	true   false (5==5)   (5<4)	true true
^	Suma lógica exclusiva – XOR (binario)	true ^ false (5==5)   (5<4)	true true
&	Producto lógico – AND (binario)	true & false (5==5) & (5<4)	false false
	Suma lógica con cortocircuito: si el primer	true    false	

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segundo se salta y el resultado es false



A	B	A OR B
F	F	F
F	V	V
V	F	V
V	V	V

A	B	A AND B
F	F	F
F	V	F
V	F	F
V	V	V

A	NOT A
F	V
V	F

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Follows standard (math) rules:

1. Parentheses
2. Arithmetic operators
  1. Multiplication and division
  2. Addition and subtraction
3. Relational operators
4. Logic operators

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Which is the result of the following expression?

$$3 + 5 < 5 * 2 \ || \ 3 > 8 \ \&\& \ 7 > 6 - 2$$

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Which is the result of the following expression?

```
3 + 5 < 5 * 2 || 3 > 8 && 7 > 6 - 2
```

```
3 + 5 < 5 * 2 || 3 > 8 && 7 > 6 - 2
8 < 10 || 3 > 8 && 7 > 4
true || false && true
true || false
true
```

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```
int i = 7;
float f = 5.5F;
char c = 'w';
```

Expresión	Resultado
<code>(i &gt;= 6) &amp;&amp; (c == 'w')</code>	
<code>(i &gt;= 6)    (c == 119)</code>	
<code>(f &lt; 11) &amp;&amp; (i &gt; 100)</code>	
<code>(c != 'p')    ((i + f) &lt;= 10)</code>	
<code>i + f &lt;= 10</code>	
<code>i &gt;= 6 &amp;&amp; c == 'w'</code>	

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```
int i = 7;  
float f = 5.5F;  
char c = 'w';
```

Expresión	Resultado
<code>(i &gt;= 6) &amp;&amp; (c == 'w')</code>	true
<code>(i &gt;= 6)    (c == 119)</code>	true
<code>(f &lt; 11) &amp;&amp; (i &gt; 100)</code>	false
<code>(c != 'p')    ((i + f) &lt;= 10)</code>	true
<code>i + f &lt;= 10</code>	false
<code>i &gt;= 6 &amp;&amp; c == 'w'</code>	true

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```
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);  
    }  
}
```

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```
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);  
    }  
}
```

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## Every Java program must contains at least one Class

- Java methods container

## A Java file could contain several classes, but just one of them being **Public**

- File name must be that of the Public class  
(ClassName.java)

```
public class PayrollApp {  
  
    public static void main(String[] args) {  
        int hours = 40;  
        double payRate = 25.0, grossPay;  
  
    }  
}
```

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## Defining classes

- Class definition starts with the **Class** keyword
- Every declaration and instruction is located between the start and end brackets of the class
- They are referred to as the **body** of the class

```
public class PayrollApp {
```

```
    public static void main(String[] args) {  
        int hours = 40;  
        double payRate = 25.0, grossPay;
```

Body  
Class

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## The main method

- Every program needs a **main** method
- It is the starting point of the program
- Always the same heading
- Always invoked when the program is run

```
public class PayrollApp {  
  
    public static void main(String[] args) {  
        int hours = 40;  
        double payRate = 25.0, grossPay;  
    }  
}
```

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## Punctuation symbols have well-defined purposes

- ; → end of instruction
- “” → Strings are located between
- {} → blocks delimitation
- () → methods arguments
- [] → arrays indexing

They also guide indentation and ease the identification of the different blocks



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Each pair of brackets identifies a code block

```
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);  
    }  
}
```

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## Human readable information in the code

- Comments are intended to introduce information that will be ignored by the compiler inside the code
- End line comment (//)

```
int usu = 0; // el número de usuarios
```

- Block comment (/\* ... \*/)

```
/*  
 * A program to list the good things in life  
 * Author: Barry Burd, BeginProg2@BurdBrain.com  
 * February 13, 2005  
 */  
  
class ThingsILike {  
  
    public static void main(String args[]) {  
        System.out.println("Chocolate, royalties, sleep");  
    }  
}
```

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