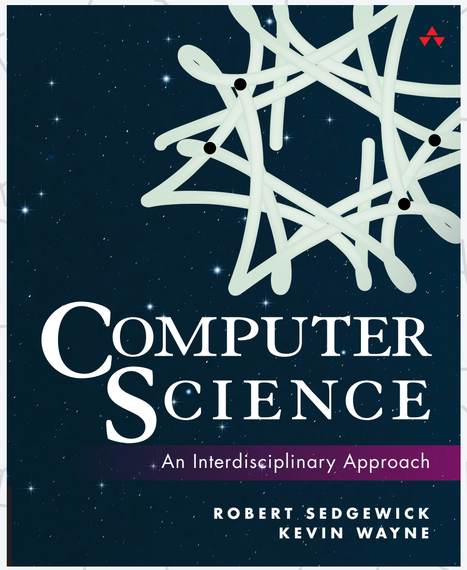

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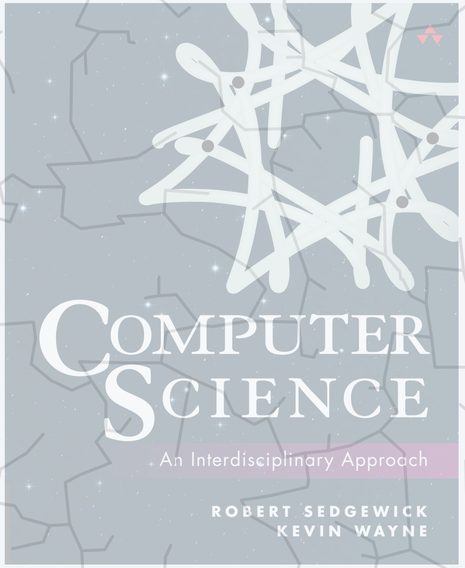
1.1 Hello, World

- *why programming?*
- *your first program*
- *program development*



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1.1 HELLO, WORLD

- *why programming?*
- *your first program*
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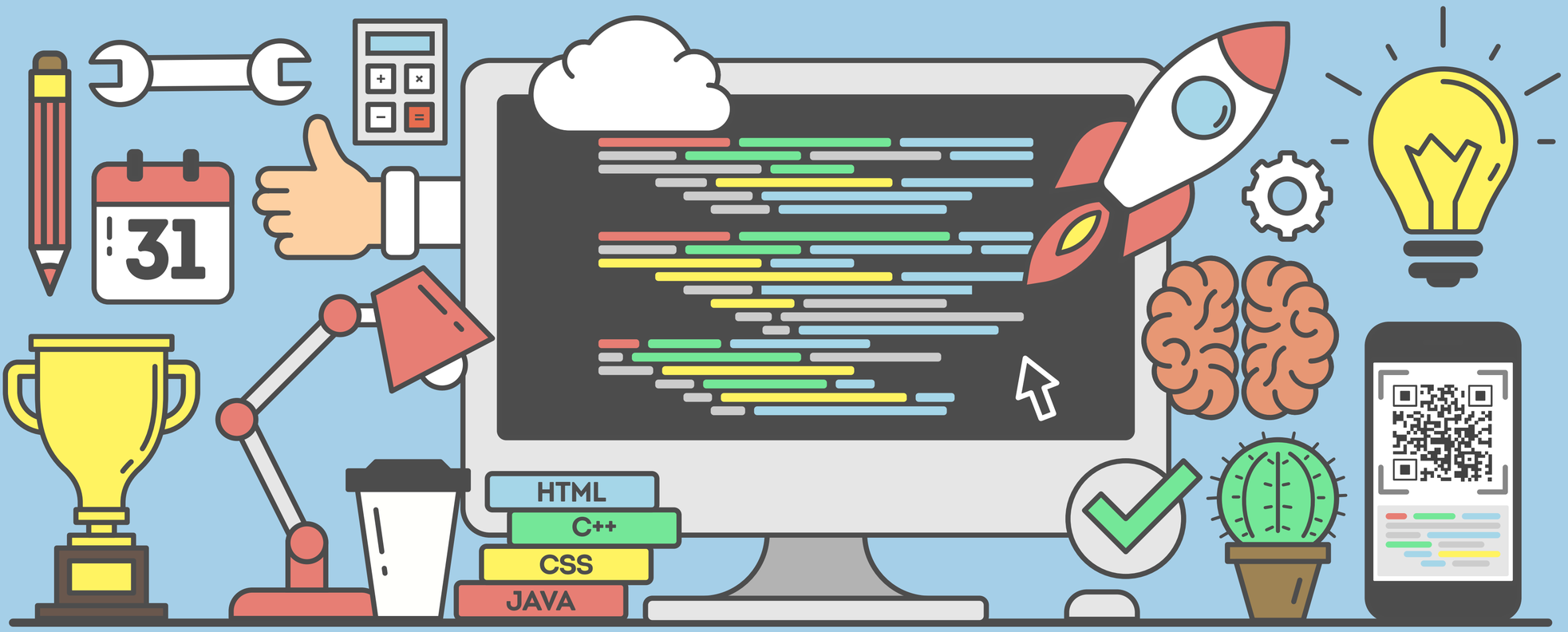
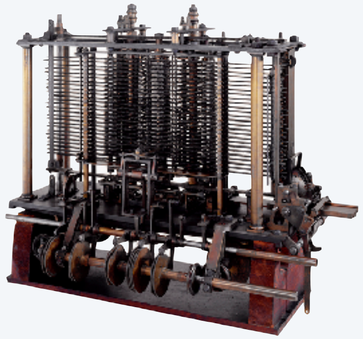
PROGRAMMING



You want to know how to program

Prepackaged solutions (apps). Great when what they do is what you want.

Programming. Empowers you to tell a computer what you want it to do.



Analytical Engine
(first computer)

Ada Lovelace
(first programmer)

Telling a computer what to do

Machine languages. Easy for computers; error-prone for people.

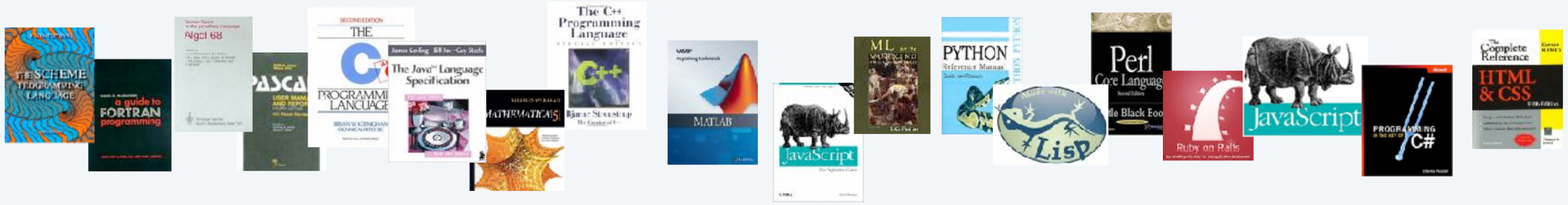
```
00111111001000011001101110010111011100111011101111010011111100110001111011111100111101111
01111011110110001100010000000100111001011100111111001101101000101001110000011000010100100
11110111011101111100001110001001010000100111000001101010011010000101011000100111001000 1...
```

Natural languages. Easy for people; error-prone for computers. ← *rapid progress in past 2 years (but not as robust as desired)*





High-level programming languages. Enables people and computers to communicate effectively.

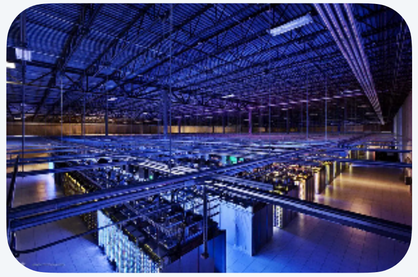


This course: Java

Java features.

- Embraces full set of modern abstractions.
- Freely available for OS X, Windows, and Linux.
- Variety of automatic checks for mistakes in programs.
- Widely used: millions of developers; billions of devices. ← *among top 3 languages for past two decades*

Ex. Android phones/TVs, web servers, Mars rover, medical devices, internet of things, …


Reality. Use different programming languages, depending on domain.

A rich subset of the Java language

Your programs will primarily consist of these plus identifiers (names) that you make up.

seems like a lot, but typical English vocabulary is 20K words!

data types

int	
double	
boolean	
char	
String	

arithmetic

+	-
*	/
++	--
%	

boolean

true	false
&&	||
!	^

type conversion

Integer.parseInt()
Double.parseDouble()

Math library

Math.min()	Math.max()
Math.sqrt()	Math.abs()
Math.log()	Math.exp()
Math.sin()	Math.cos()
Math.PI	Math.E

objects / methods

public	private
class	new
static	final
void	main()

comments

/*	*/
//	

strings

+
length()
charAt()
compareTo()
toString()

punctuation

{	}
(	)
.	,
'	"
;	

comparisons

<	>
<=	>=
==	!=

arrays

[]
length

assignment

=

flow control

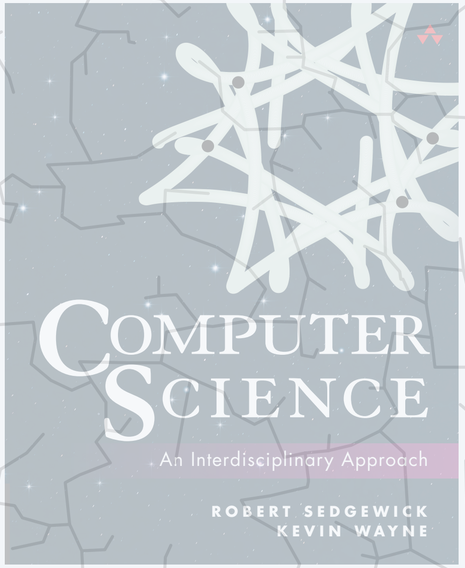
if	else
while	for
do	return
break	continue

System methods

System.out.print()
System.out.println()
System.out.printf()

our I/O libraries

StdIn/In
StdOut/Out
StdPicture/Picture
StdDraw/Draw
StdAudio



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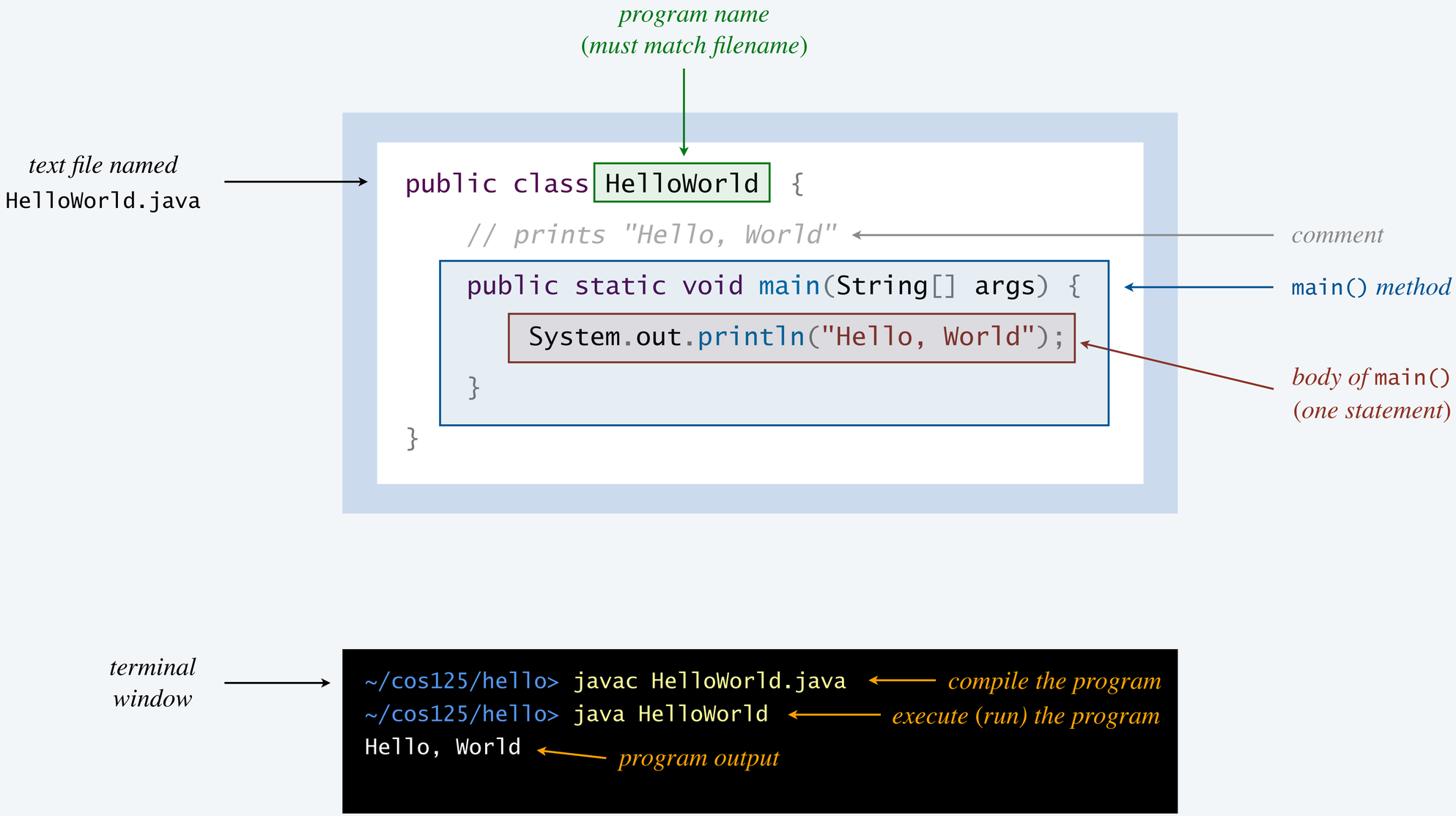
Anatomy of your first Java program



Anatomy of your first few Java programs

program name
(must match filename)

text file named
`MyProgram.java`

```
public class MyProgram {

   // prints, plays, or draws something

   public static void main(String[] args) {

      ...

      ...

      ...

   }

}
```

comment

`main()` *method*

body of `main()`
(sequence of statements)

```
~/cos125/hello> javac MyProgram.java
~/cos125/hello> java MyProgram
[program output]
```

boilerplate

```
public

class

static

void

main

String[]
```

don't worry, we'll learn about (some of) these in due time

Hello World with images

Standard picture. Our course library for working with images.

```
public class HelloWorldWithPicture {

   // prints "Hello, World" and shows image
   public static void main(String[] args) {
      System.out.println("Hello, World");
      StdPicture.read("HelloWorld.png");
      StdPicture.show();
   }
}
```

comment

`main()` *method*

body of `main()` *(sequence of statements)*

an image file

```
~/cos125/hello> javac-introcs HelloWorldWithPicture.java
~/cos125/hello> java-introcs HelloWorldWithPicture
Hello, World
```

`javac-introcs` *and* `java-introcs` *tell Java where to find our course libraries*

HelloWorld.png

Hello World with user input

Command-line arguments. Can specify string inputs when executing the program.

```
public class UseArgument {
   // prints "Hi, [name]. Bye."
   // with name given as command-line arg
   public static void main(String[] args) {
      System.out.print("Hi, ");
      System.out.print(args[0]);
      System.out.println(". Bye.");
   }
}
```

comments

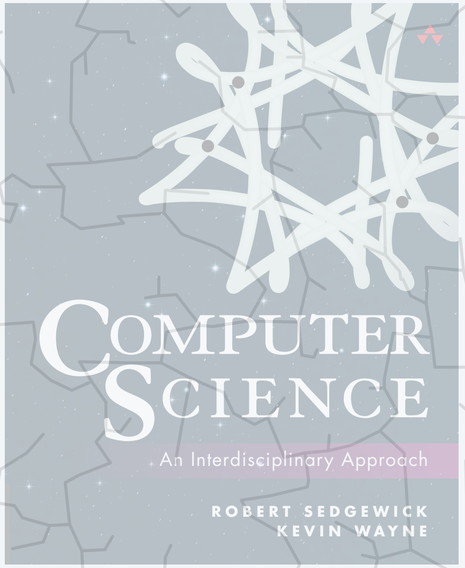
main() *method*

print() *does not end the line*

args[0] *is the first command-line argument*

println() *ends the line*

```
~/cos125/hello> javac UseArgument.java
~/cos125/hello> java UseArgument Sebastian
Hi Sebastian. Bye.
~/cos125/hello> java UseArgument Victoria
Hi Victoria. Bye.
```



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1.1 HELLO, WORLD

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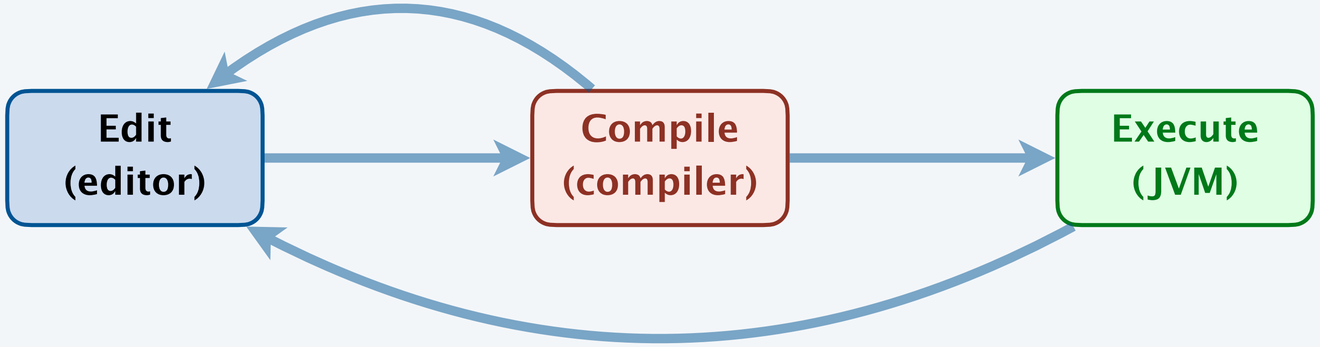
Program development in Java

Developing a Java program involves three steps:

- Edit: write your program.
- Compile: create a "machine-language" version of your program.
- Execute: run your program, taking input and producing output.



analogous to other creative processes
(Write-bomb-film Netflix special)

Almost always requires cyclic refinement:

- Not a legal Java program (compile-time error) ⇒ need to re-edit.
- A legal Java program that does the wrong thing ⇒ need to re-edit.

run-time error or
produces incorrect output

Compile-time errors

Compile-time error. A consequence of trying to compile an invalid Java program.

Ex 1.

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

```
~/cos126/hello> javac-introcs CompileTimeError.java
CompileTimeError.java:2: error: invalid method declaration;
return type required
    public static main(String[] args) {
                  ^
1 error
```

Compile-time errors

Compile-time error. A consequence of trying to compile an invalid Java program.

Ex 2.

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

```
~/cos126/hello> javac-introcs CompileTimeError2.java
AnotherCompileTimeError.java:4: error: reached end of file
while parsing
}
 ^
1 error
```

Run-time errors

Run-time error. An error that occurs when you attempt to execute the program.

Ex 1.

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

```
~/cos126/hello> javac-introcs RuntimeError.java

~/cos126/hello> java-introcs RuntimeError
Error: Main method not found in class RuntimeError, please
define the main method as:
   public static void main(String[] args)
```

Run-time errors

Run-time error. An error that occurs when you attempt to execute the program.

Ex 2.

```
public class AnotherRuntimeError {
   public static main(String[] args) {
      StdPicture.read("GoodbyeWorld.png");
   }
}
```

```
~/cos126/hello> javac-introcs AnotherRuntimeError.java

~/cos126/hello> java-introcs AnotherRuntimeError
Exception in thread "main" java.lang.IllegalArgumentException:
could not read ‘GoodybeWorld.png'
```

Coding style

Coding style. Indentation, whitespace, naming conventions, comments, …

Goal. Make it easier for programmers (including you!) to read and understand the code.

textbook

Program 1.1.1 Hello, World

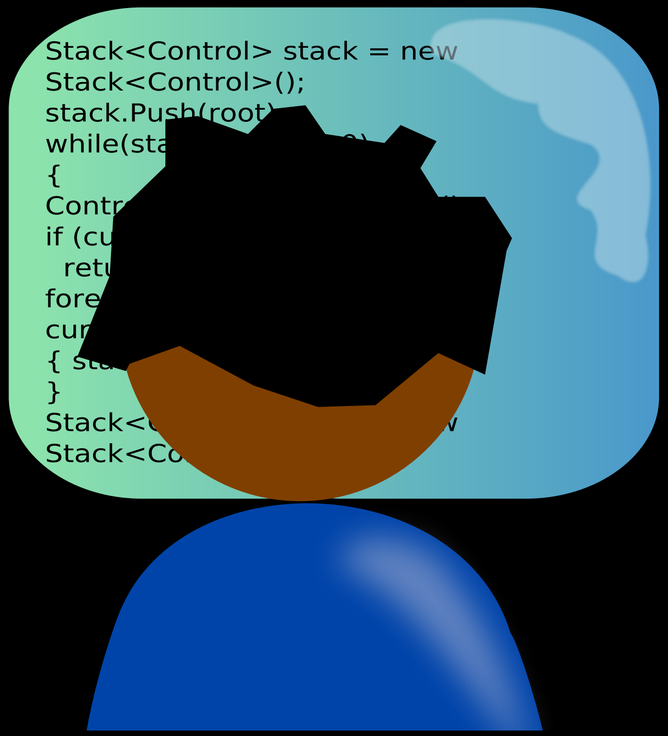
```
public class HelloWorld
{
   public static void main(String[] args)
   {
      // Prints "Hello, World" in the terminal window.
      System.out.println("Hello, World");
   }
}
```

IntelliJ

```
1  /**************************************************************************
2   *  Prints "Hello, World". By tradition, this is everyone's first program.
3   *
4   *  These first 6 lines of text are comments. They are not part of the program;
5   *  they serve to remind us about its properties.
6   **************************************************************************/
7
8  public class HelloWorld {
9      public static void main(String[] args) {
10
11         // Prints "Hello, World" in the terminal window.
12         System.out.println("Hello, World");
13     }
14 }
```

compiler

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


Stack<Control> stack = new
Stack<Control>();
stack.Push(root)
while(sta
{
Contr
if (cu
ret
fore
cur
{ sta
}
Stack<
Stack<Co

More questions

attend office hours (or stay after lecture)

ask on Ed

Credits

media	source	license
Hello, World	Adobe Stock	education license
Programming	Adobe Stock	education license
Lightbulb	VectorPortal	CC BY 4.0
Rubik's cube	WikiMedia Commons	CC BY-SA 3.0
Ada Lovelace	Margaret Sarah Carpenter	public domain
Babbage's Analytic Engine	Science Museum, London	CC BY-SA 2.0
Java Logo	Sun Microsystems	
Android Phone	nicepng.com	public domain
Google Data Center	Google / Connie Zhou	
Mars Rover	NASA / JPL / Cornell	public domain
MRI Machine	Adobe Stock	education license
Internet of Things	Adobe Stock	education license

Credits

media	source	license
Stand up stool	Adobe Stock	education license
Programmer	Jaime Botero	public domain
Students Asking Questions	Adobe Stock	education license
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MRI	By KieranMaher at English Wikibooks - Adapted with permission by Kieran Maher using Graphic Converter from Applied Imaging Technology by Heggie, Liddell & Maher (2000)	public domain
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