

# Welcome to CSE 142!

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Building Java Programs Chapter 1

Lecture 1: Introduction; Basic Java Programs

**reading: 1.1 - 1.3**

# What is computer science?

- computers?
- science?
- programming?

## **ALGORITHMIC THINKING**

### **al·go·rithm:**

a step-by-step procedure for solving a problem or accomplishing some end *especially by a computer*

## **PROCESS**

# Fields of computer science

- Graphics
- Computer Vision
- Artificial Intelligence
- Robotics
- Machine Learning
- Data Mining
- Natural Language Processing
- User Interfaces
- ...
  
- How does this all relate to programming?
  - This course is "Introduction to Programming I" after all.

# Programming is like Legos...





# Take this course if you...

- ... like solving tricky problems
- ... like building things
- ... (will) work with large data sets
- ... are curious about how Facebook, Google, etc work
- ... have never written a computer program before
- ... are shopping around for a major
  - 142 is a good predictor of who will enjoy CSE
  - ... think "computers and robots are going to take over the world. I want to befriend them so that my life will be spared."

# Tips for Success

- Come to lecture!
- Visit website often: <http://cs.washington.edu/142>
- Utilize the resources we provide you:
  - IPL (MGH 334)
  - Come visit me in Office Hours!
  - Your TA
  - Textbook
  - Slides and Lecture examples
  - Message Board
  - Practice-It! <http://practiceit.cs.washington.edu/practiceit/>
- Remember: assignments must be **your own work!**

# Tips for Success (cont'd)

- Keep up with the assignments
  - The course material is cumulative
- If you don't understand something, ask questions (especially "WHY?").
  - There's no such thing as a dumb question.
  - Computers are neither magical nor mysterious. Everything can be explained!



# What is programming?

- **program:** A set of instructions to be carried out by a computer.
- **program execution:** The act of carrying out the instructions contained in a program.
- **programming language:** A systematic set of rules used to describe computations in a format that is editable by humans.
  - We will be using a programming language called Java.



# Why Java?

- Relatively simple
- Object-oriented
- Platform independent (Mac, Windows...)
- Widely used
  - #2 in popularity  
<http://www.tiobe.com/index.php/content/paperinfo/tpci/index.html>

# Your first Java program!

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

- File must be named `Hello.java`
- What does this code *output* (print to the user) when you *run* (execute) it?

# Bigger Java program!

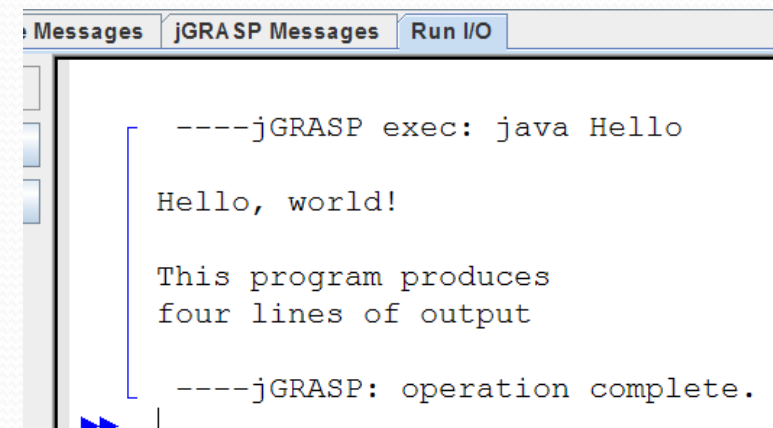
```
public class Hello {  
    public static void main(String[] args) {  
        System.out.println("Hello, world!");  
        System.out.println();  
        System.out.println("This program produces");  
        System.out.println("four lines of output");  
    }  
}
```

- **Its output:**

Hello, world!

This program produces  
four lines of output

- **console:** Text box into which the program's output is printed.



The screenshot shows a console window with three tabs: "Messages", "jGRASP Messages", and "Run I/O". The "jGRASP Messages" tab is active and displays the following output:

```
----jGRASP exec: java Hello  
  
Hello, world!  
  
This program produces  
four lines of output  
  
----jGRASP: operation complete.
```

# Running a program

## 1. Write it.

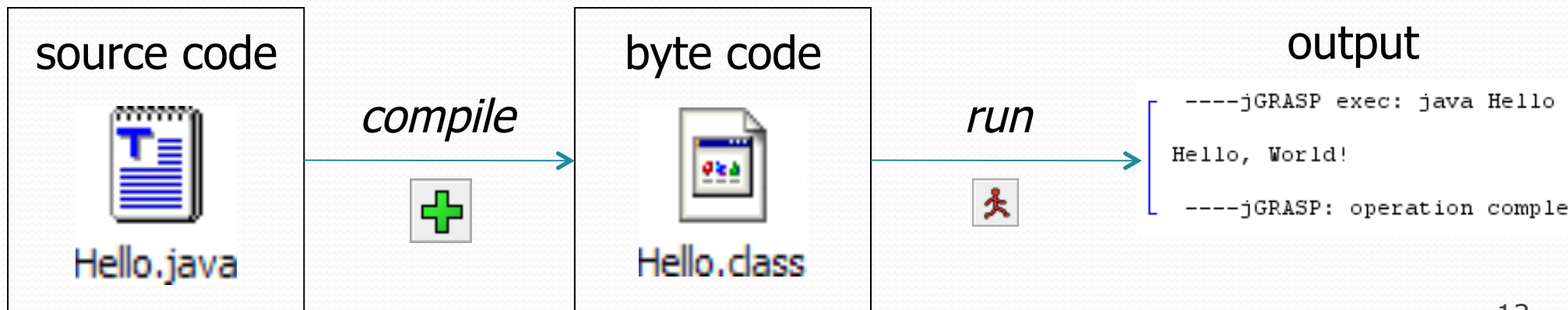
- **code** or **source code**: The set of instructions in a program.

## 2. Compile it.

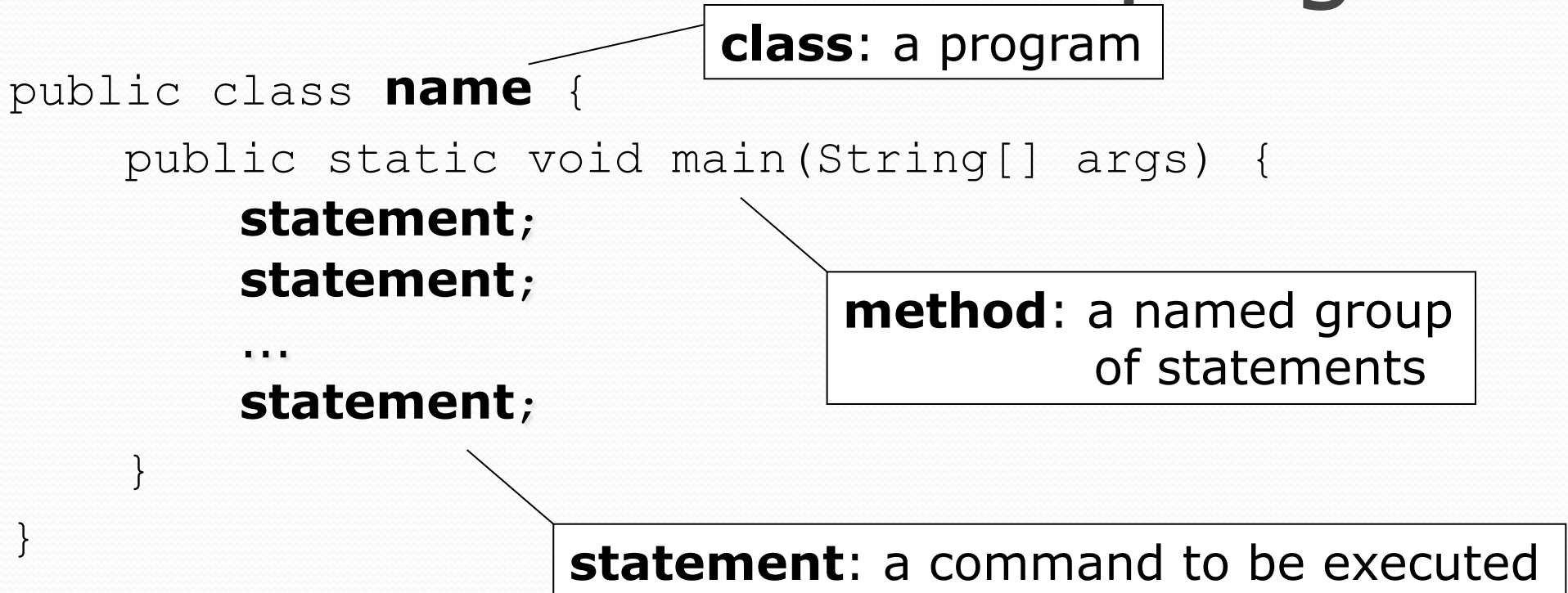
- **compile**: Translate a program from one language to another.
- **byte code**: The Java compiler converts your code into a format named *byte code* that runs on many computer types.

## 3. Run (execute) it.

- **output**: The messages printed to the user by a program.



# Structure of a Java program



- Every executable Java program consists of a **class**,
  - that contains a **method** named `main`,
    - that contains the **statements** (commands) to be executed.

# Names and identifiers

- You must give your program a name.

```
public class HelloWorld {
```

- Naming convention: capitalize each word (e.g. MyClassName)
- Your program's file must match exactly (HelloWorld.java)
  - includes capitalization (Java is "case-sensitive")
- **identifier**: A name given to an item in your program.
  - must start with a letter or `_` or `$`
  - subsequent characters can be any of those or a number
    - **legal**: `_myName`    `TheCure`    `ANSWER_IS_42`    `$bling$`
    - **illegal**: `me+u`    `49ers`    `side-swipe`    `Ph.D's`

# Keywords

- **keyword**: An identifier that you cannot use because it already has a reserved meaning in Java.

abstract	default	if	private	this
boolean	do	implements	protected	throw
break	double	import	<b>public</b>	throws
byte	else	instanceof	return	transient
case	extends	int	short	try
catch	final	interface	<b>static</b>	<b>void</b>
char	finally	long	strictfp	volatile
<b>class</b>	float	native	super	while
const	for	new	switch	
continue	goto	package	synchronized	

- Note: Because Java is case-sensitive, you could technically use `Class` or `cLaSs` as identifiers, but this is very confusing and thus **strongly discouraged**.



# System.out.println

- A statement that prints a line of output on the console.
  - pronounced "print-linn"
- Two ways to use `System.out.println` :
  - `System.out.println("text");`  
Prints the given message as output.
  - `System.out.println();`  
Prints a blank line of output.

# Syntax

- **syntax**: The set of legal structures and commands that can be used in a particular language.
  - The “spelling” and “grammar” of a programming language.
  - Every basic Java statement ends with a semicolon ;
  - The contents of a class or method occur between { and }
- **syntax error (compiler error)**: A problem in the structure of a program that causes the compiler to fail.
  - Missing semicolon
  - Too many or too few { } braces
  - Class and file names do not match
  - ...

# Syntax error example

```
1 public class Hello {
2     poublic static void main(String[] args) {
3         System.owt.println("Hello, world!")_
4     }
5 }
```

- **Compiler output:**

```
Hello.java:2: <identifier> expected
    poublic static void main(String[] args) {
      ^
```

```
Hello.java:3: ';' expected
    }
    ^
```

2 errors

- The compiler shows the line number where it found the error.
- The error messages can be tough to understand!
  - Why can't the computer just say "*You misspelled 'public'*"?

# More on syntax errors

- Java is case-sensitive
  - Hello and hello are not the same

```
1 Public class Hello {
2     public static void main(String[] args) {
3         System.out.println("Hello, world!");
4     }
5 }
```

compiler output:

```
Hello.java:1: class, interface, or enum expected
Public class Hello {
^
1 error
```

# First lesson in this class

- Computers are stupid.
- Computers can't read minds.
- Computers don't make mistakes.
- If the computer is not doing what you want, it's because **YOU** made a mistake.



# Strings and escape sequences

# Strings

- **string**: A sequence of text characters.
  - Starts and ends with a " (quotation mark character).
    - The quotes do not appear in the output.
  - Examples:

```
"hello"  
"This is a string.  It's very long!"
```
- Restrictions:
  - May not span multiple lines.

```
"This is not  
a legal String."
```
  - May not contain a " character.

```
"This is not a "legal" String either."
```
- This begs the question...

# Escape sequences

- **escape sequence:** A special sequence of characters used to represent certain special characters in a string.

\t     tab character  
\n     new line character  
\ "     quotation mark character  
\ \     backslash character

- **Example:**

```
System.out.println("\\hello\nhow\tare \"you\"?\\\\");
```

- **Output:**

```
\hello  
how     are "you"?\\
```



# Questions

- What is the output of the following `println` statements?

```
System.out.println("\ta\tb\tc");  
System.out.println("\\\\");  
System.out.println("'");  
System.out.println("\"\"");  
System.out.println("C:\nin\the downward spiral");
```

- Write a `println` statement to produce this output:

```
/ \ // \\ /// \\\
```

# Answers

- Output of each `println` statement:

```
      a      b      c
\\
|
" " "
C:
in      he downward spiral
```

- `println` statement to produce the line of output:

```
System.out.println("/ \\ // \\\生 /// \\\生\\生");
```

# Questions

- What `println` statements will generate this output?

```
This quote is from  
Irish poet Oscar Wilde:
```

```
"Music makes one feel so romantic  
- at least it always gets on one's nerves -  
which is the same thing nowadays."
```

- What `println` statements will generate this output?

```
A "quoted" String is  
'much' better if you learn  
the rules of "escape sequences."
```

```
Also, "" represents an empty String.  
Don't forget: use \" instead of " !  
' is not the same as "
```

# Answers

- **println statements to generate the output:**

```
System.out.println("This quote is from");
System.out.println("Irish poet Oscar Wilde:");
System.out.println();
System.out.println("\"Music makes one feel so romantic");
System.out.println("- at least it always gets on one's nerves -");
System.out.println("which is the same thing nowadays.\"");
```

- **println statements to generate the output:**

```
System.out.println("A \"quoted\" String is");
System.out.println("'much' better if you learn");
System.out.println("the rules of \"escape sequences.\"");
System.out.println();
System.out.println("Also, \"\" represents an empty String.");
System.out.println("Don't forget: use \"\" instead of \" !");
System.out.println("' is not the same as \"");
```