Building Java Programs

A Back to Basics Approach

CS 210

CHAPTER 1

INTRODUCTION TO JAVA PROGRAMMING

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Topics will be covered

CS 210

- What is Computer Science?
- What is Programming?
- Basic Java Program (with `println` statements)
  - Structure
  - Identifier names
  - Syntax
  - Strings
  - Comments
- Static Methods and Algorithms
  - Structured Version
  - Unstructured With Redundancy Version
  - Unstructured Without Redundancy Version

What is Computer Science?

Computers? Sciences? Programming?
Late lonely nights in front of computer? Or…

- Computer Science (from Wikipedia)

  The study of theoretical foundations of information and computation and their implementation and application in computer systems.

- Algorithmic Thinking

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

- Computer Engineering (CSE)
  - Overlap with CS and EE; emphasizes hardware

Many subfields

- Graphics, Computer Vision
- Artificial Intelligence
- Scientific Computing
- Robotics
- Databases, Data Mining
- User Interface
- Natural Language Processing …

CS Job Market

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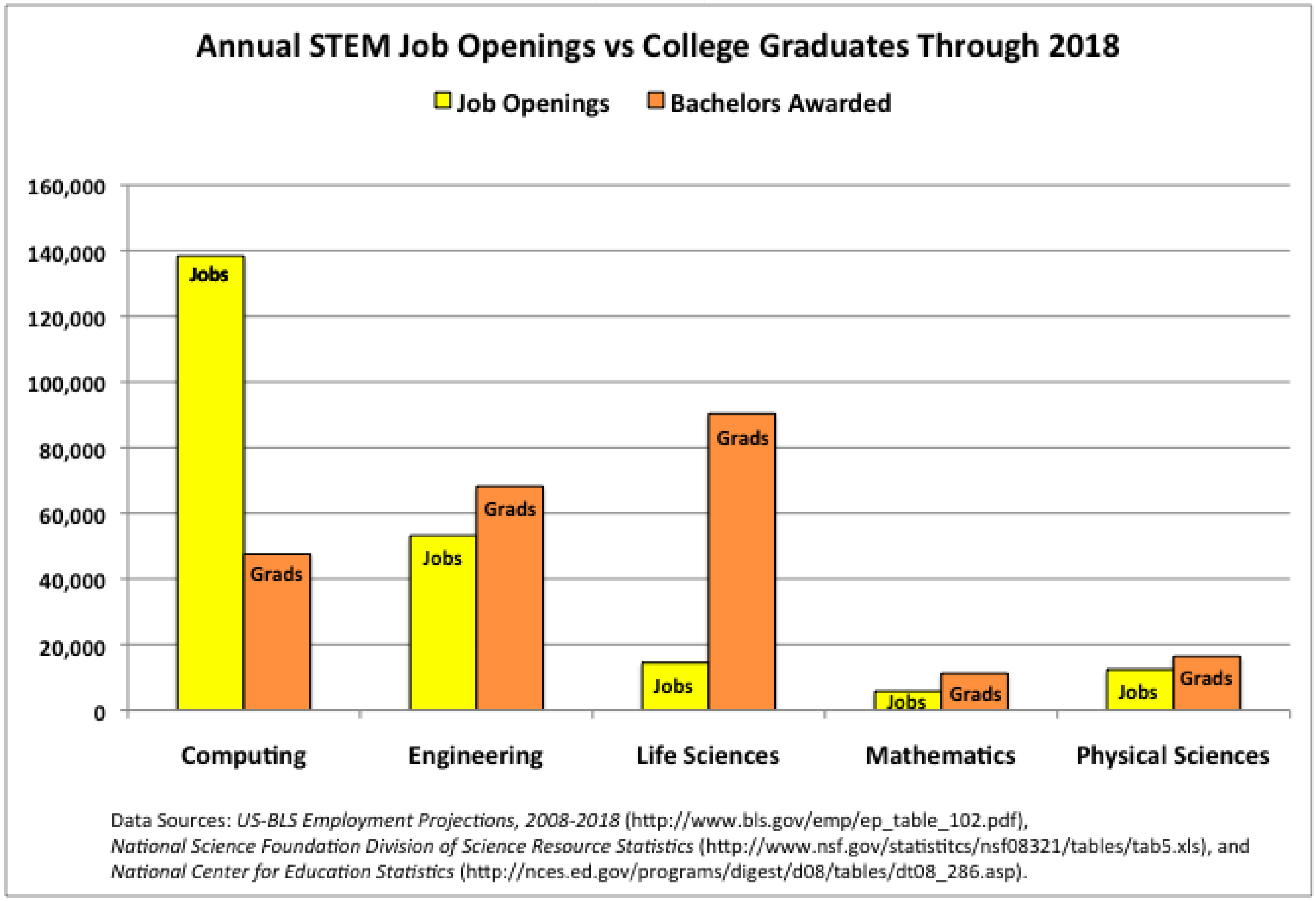


Data Sources: *US-BLS Employment Projections, 2008-2018* (http://www.bls.gov/emp/ep_table_102.pdf), *National Science Foundation Division of Science Resource Statistics* (http://www.nsf.gov/statistitcs/nsf08321/tables/tab5.xls), and *National Center for Education Statistics* (http://nces.ed.gov/programs/digest/d08/tables/dt08_286.asp).

What is programming?

- **program**: A set of instructions to be carried out by a computer.

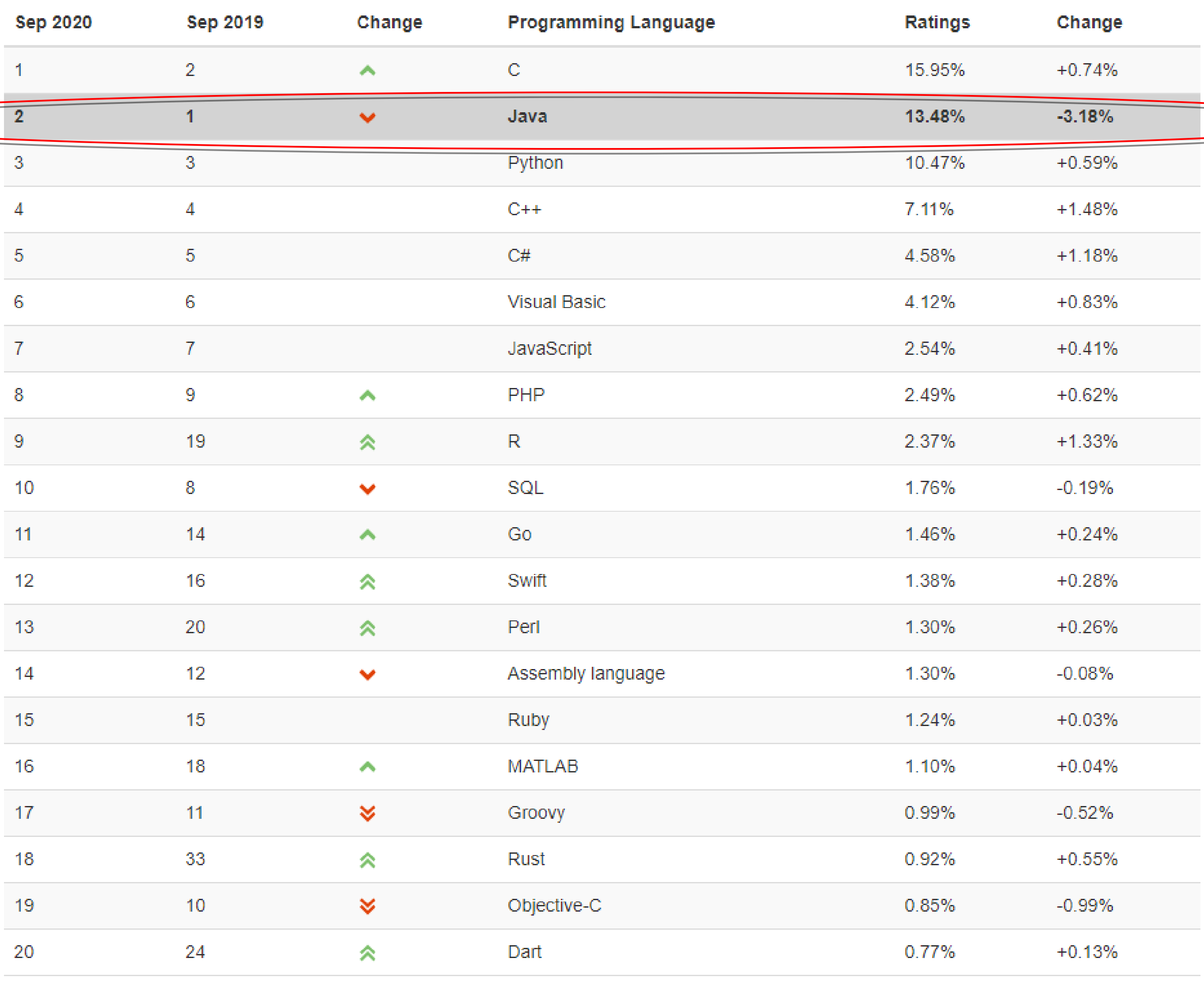
- **program execution**: The act of carrying out the instructions contained in a program.

- **programming language**: A systematic set of rules used to describe computations in a format that is editable by humans.
  - This textbook teaches programming in a language named Java.

Some modern languages

- *procedural languages*: programs are a series of commands
  - **Pascal** (1970): designed for education
  - **C** (1972): low-level operating systems and device drivers
- *functional programming*: functions map inputs to outputs
  - **Lisp** (1958) / **Scheme** (1975), **ML** (1973), **Haskell** (1990)
- *object-oriented languages*: programs use interacting "objects"
  - **Smalltalk** (1980): first major object-oriented language
  - **C++** (1985): "object-oriented" improvements to C
    - successful in industry; used to build major OSes such as Windows
  - **Java** (1995): designed for embedded systems, web apps/servers
    - Runs on many platforms (Windows, Mac, Linux, cell phones...)
    - The language taught in this textbook

TIOBE Programming Community Index



Sep 2020	Sep 2019	Change	Programming Language	Ratings	Change
1	2	↑	C	15.95%	+0.74%
2	**1**	↓	**Java**	**13.48%**	**-3.18%**
3	3		Python	10.47%	+0.59%
4	4		C++	7.11%	+1.48%
5	5		C#	4.58%	+1.18%
6	6		Visual Basic	4.12%	+0.83%
7	7		JavaScript	2.54%	+0.41%
8	9	↑	PHP	2.49%	+0.62%
9	19	⇈	R	2.37%	+1.33%
10	8	↓	SQL	1.76%	-0.19%
11	14	↑	Go	1.46%	+0.24%
12	16	⇈	Swift	1.38%	+0.28%
13	20	⇈	Perl	1.30%	+0.26%
14	12	↓	Assembly language	1.30%	-0.08%
15	15		Ruby	1.24%	+0.03%
16	18	↑	MATLAB	1.10%	+0.04%
17	11	⇊	Groovy	0.99%	-0.52%
18	33	⇈	Rust	0.92%	+0.55%
19	10	⇊	Objective-C	0.85%	-0.99%
20	24	⇈	Dart	0.77%	+0.13%

Myths

- CS/CSE majors spend lives in dark offices alone writing code
- CS/CSE is only about lines and lines of details
- CS/CSE is not creative
- CS/CSE is only for people that want to work at large software companies
- All the jobs moved to Bangalore
- …

See more at: http://www.cs.washington.edu/whycse

Should you take this course?

- NO
  - “I hate computers.”
  - “I don’t pay attention to details.”
    - Programming is fairly detail-oriented.
  - “I refuse to think logically.”
  - “I want to take an easy class.”
    - Hard for those who find difficulty in logical thinking and who don’t pay attention to details.

Should you take this course?

- PROBABLY NOT
  - “I want free gourmet meals and to make lots of money by working for Google.”
  - “World of Warcraft rocks hardcore!”
  - “Everyone, look at my Facebook farm!”
  - “I’ve programmed before, so I can just coast through this for an easy A!“

Should you take this course?

- YES
  - “I have to take this class.”
    - Is this the only reason? Are you pursuing the right major?
  - “I like to solve problems.”
  - “Computers and robots are going to take over the world. I want to befriend them so that my life will be spared.”

Basic Java programs with `println` statements

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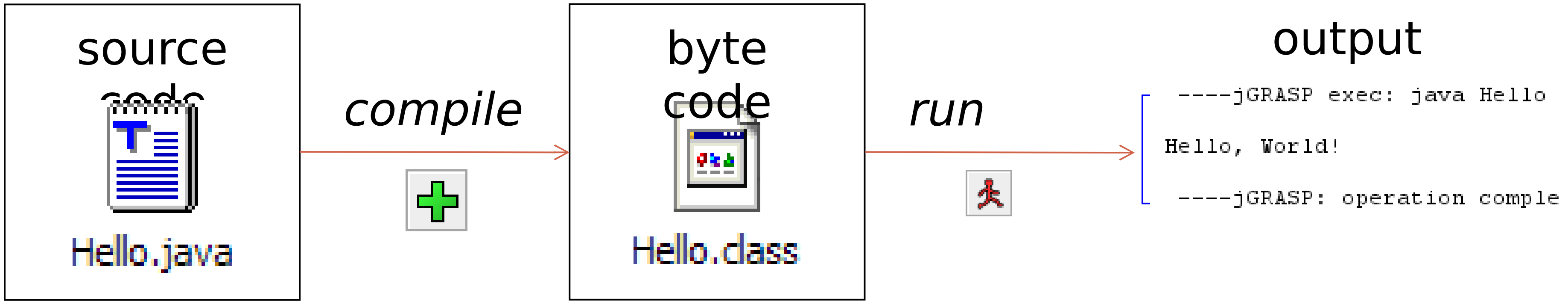
STRUCTURE
IDENTIFIER NAMES
SYNTAX
STRINGS
COMMENTS

Compile/run a Java 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.



```
----jGRASP exec: java Hello
Hello, World!
----jGRASP: operation comple
```

Example Java program

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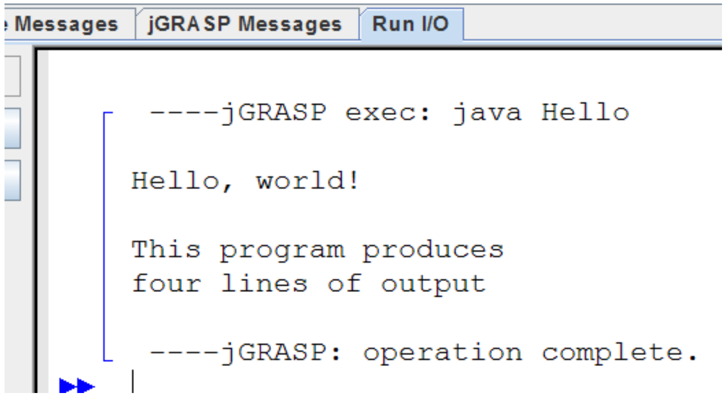
```
public class Hello {
    public static void main(String[] args) {
        System.out.println("Hello, world!");
        System.out.println();
        System.out.println("This program produces");
        System.out.println("four lines of output");
    }
}
```

- Its output:

```
Hello, world!

This program produces
four lines of output
```

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



```
----jGRASP exec: java Hello

Hello, world!

This program produces
four lines of output

----jGRASP: operation complete.
```

Structure of a Java program

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```
public class Name {
    public static void main(String[] args) {
        statement;
        statement;
        ...
        statement;
    }
}
```

class: a program

method: a named group of statements

statement: a command to be executed

- 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

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

- You must give your program a name.

  `public class MyProgram {`

  - Naming convention: Capitalize each word (e.g. `MyClassName`)
  - Your program's file must match exactly (`MyProgram.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`
    - **Why?**

Keywords

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

- **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	**public**	throws
byte	else	instanceof	return	transient
case	extends	int	short	try
catch	final	interface	**static**	**void**
char	finally	long	strictfp	volatile
class	float	native	super	while
const	for	new	switch	
continue	goto	package	synchronized	

System.out.println

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

- A statement that prints a line of output on the console.
  - pronounced "print-linn"
  - sometimes called a "println statement" for short

- Two ways to use `System.out.println` :

  - `System.out.println(`“**Your Message**`");`
    Prints the given message as output.

  - `System.out.println();`
    Prints a blank line of output.

Syntax

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

- **syntax**: The set of legal structures and commands that can be used in a particular 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
  - Illegal identifier for class name
  - Class and file names do not match… and many more

Syntax error example

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

- **Compiler output:**

```
Hello.java:2: <identifier> expected
    pooblic 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!

Strings

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

- **string**: A sequence of characters to be printed.
  - Starts and ends with a " quote " character.
    - The quotes do not appear in the output.
  - Examples:

```
"hello"
"This is a string.  It's fairly 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."
```

Escape sequences

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

`\t`	tab character (Note: use FOUR spaces to represent)
`\n`	new line character
`\"`	quotation mark character
`\\`	backslash character

  - Example:

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

  - Output:

```
\hello
how    are "you"?\\
```

Exercise 1

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- #1 - #5: What is the output of the following `println` statements?

```
1. System.out.println("a\tb\tc");
2. System.out.println("\\\\");
3. System.out.println("'");
4. System.out.println("\"\"\"");
5. System.out.println("C:/in\the downward spiral");
```

- #6: Write a `println` statement to produce this output.

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

Fill in your answers…

- Output of each `println` statement:

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

Exercise 2

- What `println` statements will generate this output?

```
This program prints a
quote from the Gettysburg Address.

"Four score and seven years ago,
our 'fore fathers' brought forth on
this continent a new nation."
```

- 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 "
```

Fill in your answers…

- `println` statements to generate the output:

- `println` statements to generate the output:

Comments

- **comment**: A note written in source code by the programmer to describe or clarify the code.
  - Comments are not executed when your program runs.

- Syntax:

```
// comment text, on one line
   or,
/* comment text; may span multiple lines */
```

- Examples:

```
// This is a one-line comment.

/* This is a very long
   multi-line comment. */
```

Using comments

- Where to place comments:
  - at the top of each file (a "comment header")
  - at the start of every method (seen later)
  - to explain complex pieces of code

- Comments are useful for:
  - Understanding larger, more complex programs.
  - Multiple programmers working together, who must understand each other's code.

Comments example

```
/* Maroon 5 Fan Student, CS 210, Winter 2012
   This program prints lyrics about ... Moves Like Jagger */

public class MovesLikeJagger {
    public static void main(String[] args) {
        // first verse
        System.out.println("Just shoot for the stars");
        System.out.println("If it feels right");
        System.out.println("Then aim for my heart");
       …
        System.out.println();

        // second verse
        System.out.println("Maybe it's hard");
        System.out.println("When you feel like you're broken
  and scarred");
        System.out.println("Nothing feels right");
       …
        System.out.println();
    }
}
```

Static methods and algorithms

CS 210

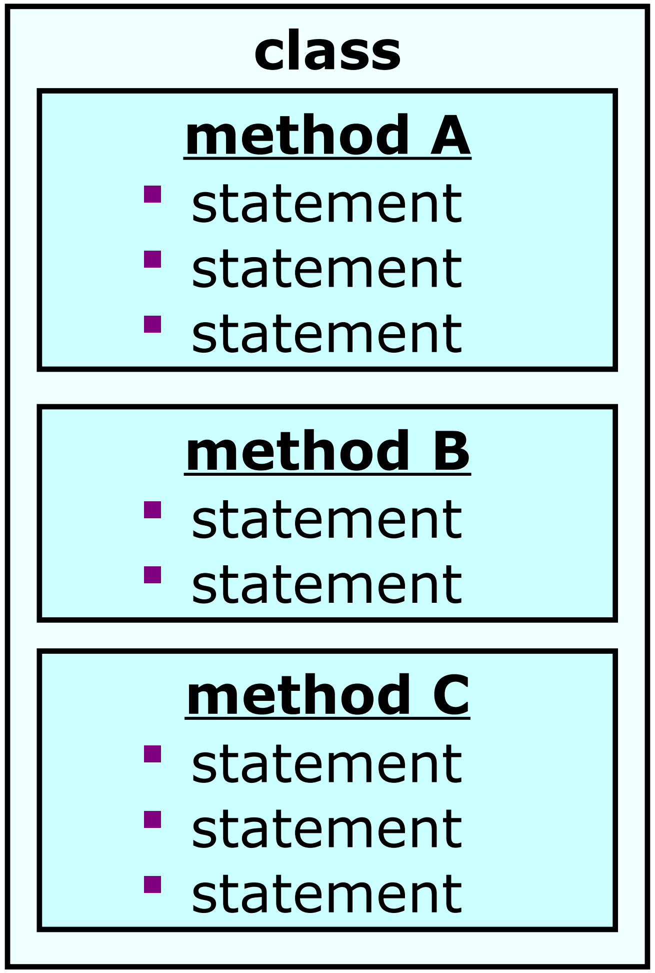
STATIC METHODS
ALGORITHMS
BAKE COOKIES EXAMPLE

Static methods

- **static method**: A named group of statements.
  - denotes the *structure* of a program
  - eliminates *redundancy* by code reuse

  - **procedural decomposition**: dividing a problem into methods

- Writing a static method is like adding a new command to Java.



Using static methods

1. **Design** the algorithm.
   - Look at the structure, and which commands are repeated.
   - Decide what are the important overall tasks.

2. **Declare** (write down) the methods.
   - Arrange statements into groups and give each group a name.

3. **Call** (run) the methods.
   - The program's `main` method executes the other methods to perform the overall task.

Declaring a method

Gives your method a name so it can be executed

- Syntax:

```
public static void name() {
    statement;
    statement;
    ...
    statement;
}
```

- Example:

```
public static void printClassSchedule() {
    System.out.println("CS 210 Fundamentals of CS I");
    System.out.println("MW 10:30am to 12:20pm");
}
```

Calling a method

Executes the method's code

- Syntax:

  name();

  - You can call the same method many times if you like.

- Example:

  ```
  printClassSchedule();
  ```

  - Output:

  ```
  CS 210 Fundamentals of CS I
  MW 10:30am to 12:20pm
  ```

Program with static method

```
public class FreshPrince {
    public static void main(String[] args) {
        rap();                  // Calling (running) the rap method
        System.out.println();
        rap();                  // Calling the rap method again
}

    // This method prints the lyrics to my favorite song.
    public static void rap() {
        System.out.println("Now this is the story all about how");
        System.out.println("My life got flipped turned upside-down");
    }
}
```

Output:

```
Now this is the story all about how
My life got flipped turned upside-down

Now this is the story all about how
My life got flipped turned upside-down
```

Methods calling methods

```
public class MethodsExample {
    public static void main(String[] args) {
        message1();
        message2();
        System.out.println("Done with main.");
    }

    public static void message1() {
        System.out.println("This is message1.");
    }

    public static void message2() {
        System.out.println("This is message2.");
        message1();
        System.out.println("Done with message2.");
    }
}
```

- **Output:**

```
This is message1.
This is message2.
This is message1.
Done with message2.
Done with main.
```

Control flow

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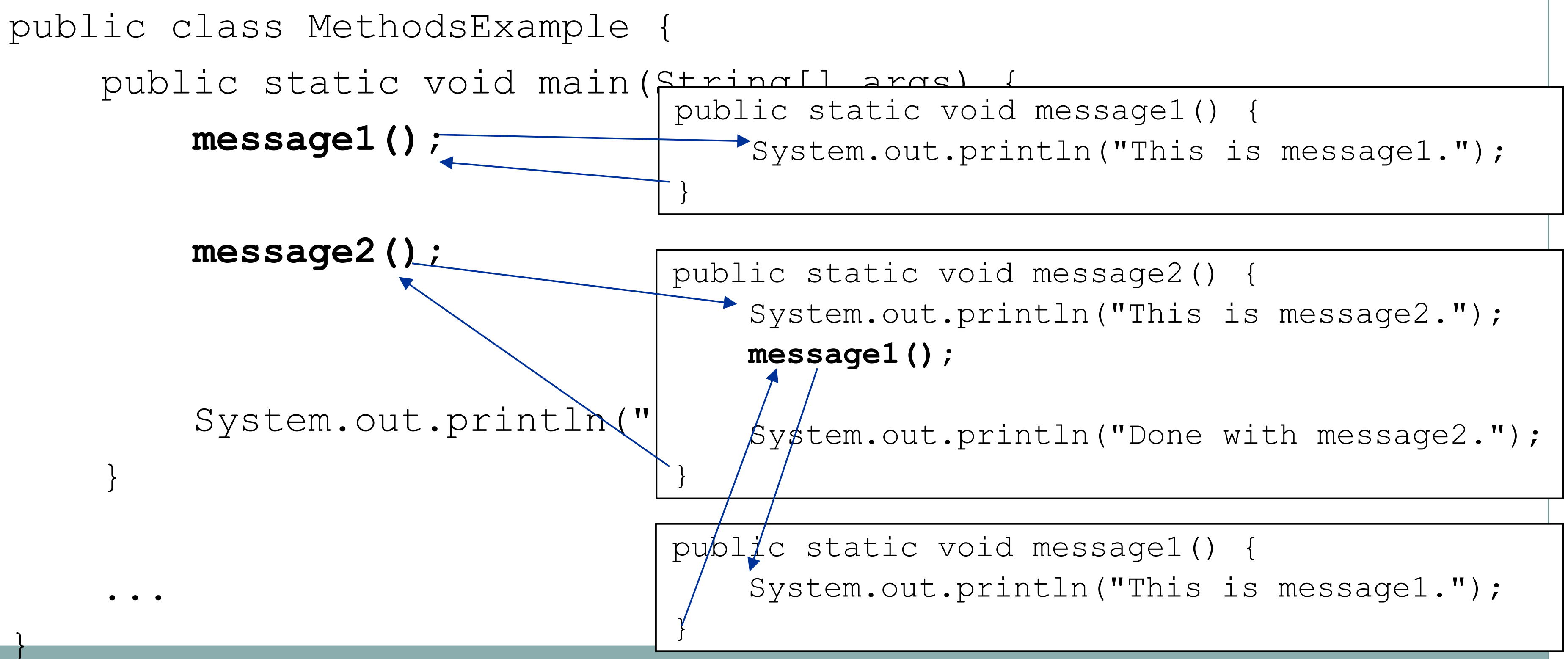
play Slide Show for better displays

- When a method is called, the program's execution...
  - "jumps" into that method, executing its statements, then
  - "jumps" back to the point where the method was called.



```
public class MethodsExample {
    public static void main(String[] args) {
        message1();

        message2();


        System.out.println("
    }

    ...
}
```

```
public static void message1() {
    System.out.println("This is message1.");
}
```

```
public static void message2() {
    System.out.println("This is message2.");
    message1();

    System.out.println("Done with message2.");
}
```

```
public static void message1() {
    System.out.println("This is message1.");
}
```

Algorithms

- **algorithm**: A list of steps for solving a problem.
- Example algorithm: "Bake sugar cookies"
  - Mix the dry ingredients.
  - Cream the butter and sugar.
  - Beat in the eggs.
  - Stir in the dry ingredients.
  - Set the oven temperature.
  - Set the timer.
  - Place the cookies into the oven.
  - Allow the cookies to bake.
  - Spread frosting and sprinkles onto the cookies.
  - ...

Problems with algorithms

- *lack of structure*: Many tiny steps; tough to remember.
- *redundancy*: Consider making a double batch...
  - Mix the dry ingredients.
  - Cream the butter and sugar.
  - Beat in the eggs.
  - Stir in the dry ingredients.
  - Set the oven temperature.
  - Set the timer.
  - Place the first batch of cookies into the oven.
  - Allow the cookies to bake.
  - Set the timer.
  - Place the second batch of cookies into the oven.
  - Allow the cookies to bake.
  - Mix ingredients for frosting.
  - ...

Structured algorithms

- **structured algorithm**: Split into coherent tasks.

1. Make the cookie batter.
   - Mix the dry ingredients.
   - Cream the butter and sugar.
   - Beat in the eggs.
   - Stir in the dry ingredients.

2. Bake the cookies.
   - Set the oven temperature.
   - Set the timer.
   - Place the cookies into the oven.
   - Allow the cookies to bake.

3. Add frosting and sprinkles.
   - Mix the ingredients for the frosting.
   - Spread frosting and sprinkles onto the cookies.

...

Removing redundancy

- A well-structured algorithm can describe repeated tasks with less redundancy.

1 Make the cookie batter.
- Mix the dry ingredients.
- ...

2a Bake the cookies (first batch).
- Set the oven temperature.
- Set the timer.
- ...

2b Bake the cookies (second batch).

3 Decorate the cookies.
- ...

A program with redundancy

```
public class BakeCookies {
    public static void main(String[] args) {
        System.out.println("Mix the dry ingredients.");
        System.out.println("Cream the butter and sugar.");
        System.out.println("Beat in the eggs.");
        System.out.println("Stir in the dry ingredients.");
        System.out.println("Set the oven temperature.");
        System.out.println("Set the timer.");
        System.out.println("Place a batch of cookies into the
  oven.");
        System.out.println("Allow the cookies to bake.");
        System.out.println("Set the oven temperature.");
        System.out.println("Set the timer.");
        System.out.println("Place a batch of cookies into the
  oven.");
        System.out.println("Allow the cookies to bake.");
        System.out.println("Mix ingredients for frosting.");
        System.out.println("Spread frosting and sprinkles.");
    }
}
```

Design of an algorithm

```
// This program displays a delicious recipe for baking cookies.
public class BakeCookies2 {
    public static void main(String[] args) {
        // Step 1: Make the cake batter.
        System.out.println("Mix the dry ingredients.");
        System.out.println("Cream the butter and sugar.");
        System.out.println("Beat in the eggs.");
        System.out.println("Stir in the dry ingredients.");

        // Step 2a: Bake cookies (first batch).
        System.out.println("Set the oven temperature.");
        System.out.println("Set the timer.");
        System.out.println("Place a batch of cookies into the oven.");
        System.out.println("Allow the cookies to bake.");

        // Step 2b: Bake cookies (second batch).
        System.out.println("Set the oven temperature.");
        System.out.println("Set the timer.");
        System.out.println("Place a batch of cookies into the oven.");
        System.out.println("Allow the cookies to bake.");

        // Step 3: Decorate the cookies.
        System.out.println("Mix ingredients for frosting.");
        System.out.println("Spread frosting and sprinkles.");
    }
}
```

Final cookie program

```
// This program displays a delicious recipe for baking cookies.
public class BakeCookies3 {
    public static void main(String[] args) {
        makeBatter();
        bake();          // 1st batch
        bake();          // 2nd batch
        decorate();
    }

    // Step 1: Make the cake batter.
    public static void makeBatter() {
        System.out.println("Mix the dry ingredients.");
        System.out.println("Cream the butter and sugar.");
        System.out.println("Beat in the eggs.");
        System.out.println("Stir in the dry ingredients.");
    }

    // Step 2: Bake a batch of cookies.
    public static void bake() {
        System.out.println("Set the oven temperature.");
        System.out.println("Set the timer.");
        System.out.println("Place a batch of cookies into the
  oven.");
        System.out.println("Allow the cookies to bake.");
    }

    // Step 3: Decorate the cookies.
    public static void decorate() {
        System.out.println("Mix ingredients for frosting.");
        System.out.println("Spread frosting and sprinkles.");
    }
}
```

Why methods part I?

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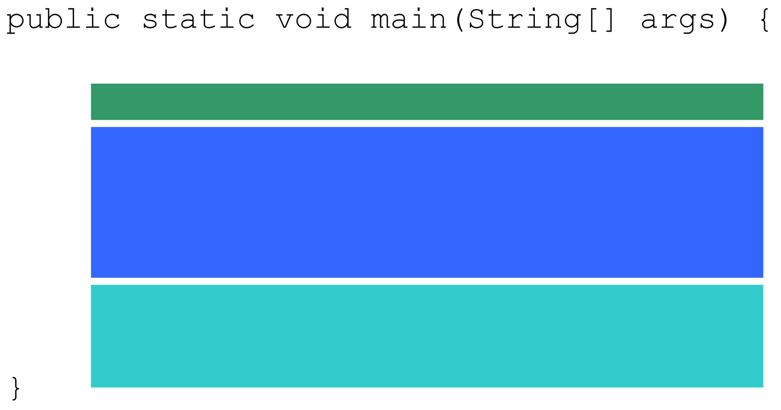
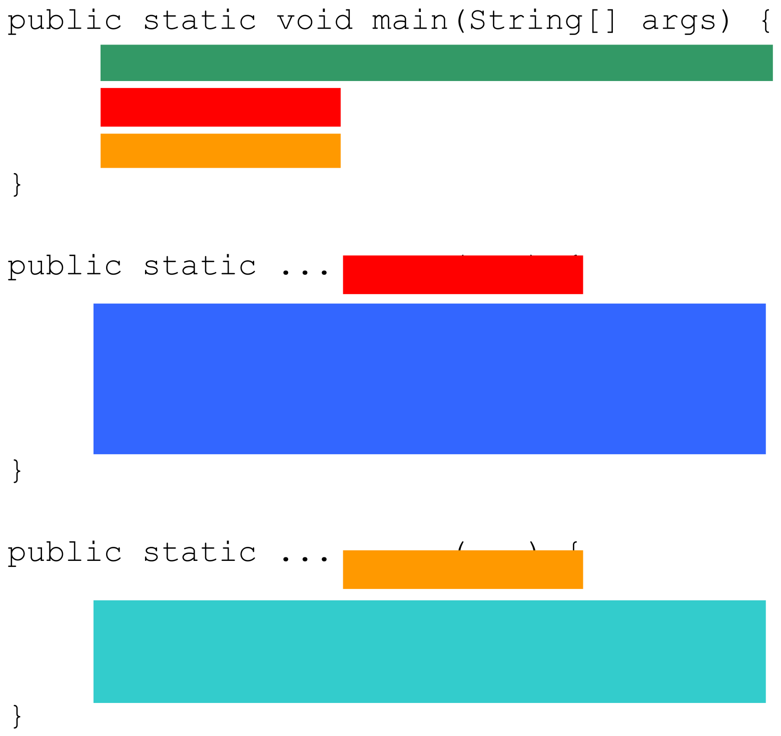
- Makes code easier to read by capturing the structure of the program
  - `main` should be a good summary of the program



```
public static void main(String[] args) {

}
```



```
public static void main(String[] args) {

}

public static ...

}

public static ...

}
```

Note: Longer code doesn't necessarily mean worse code

Why methods part II?

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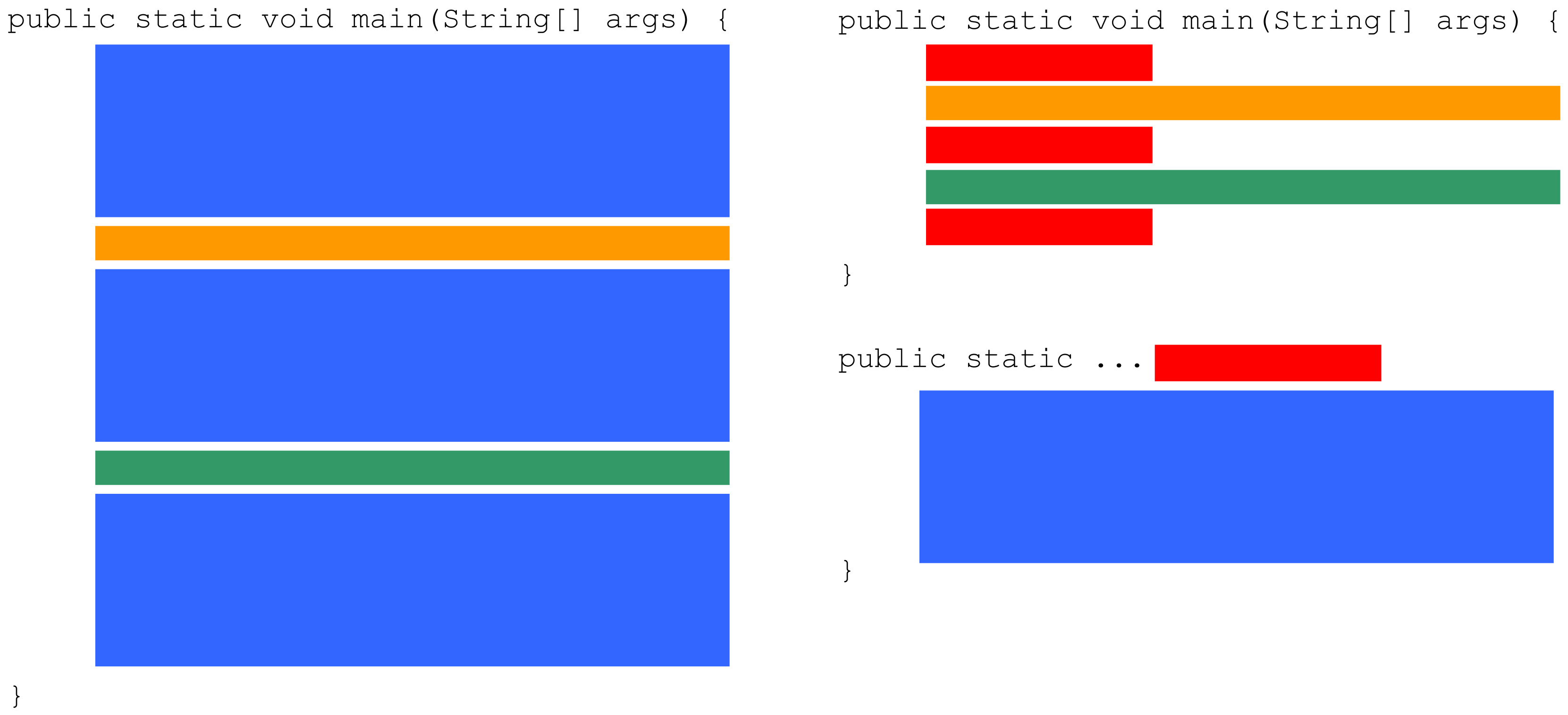
- Eliminate redundancy



```
public static void main(String[] args) {

}
```

```
public static void main(String[] args) {

}

public static ...

}
```

When to use methods

- Place statements into a static method if:
  - The statements are related structurally, and/or
  - The statements are repeated.

- You should not create static methods for:
  - An individual `println` statement.
  - Only blank lines. (Put blank `println`s in `main`.)
  - Unrelated or weakly related statements.
    (Consider splitting them into two smaller methods.)

Drawing complex figures with static methods

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UNSTRUCTURED VERSION
STRUCTURED WITH REDUNDANCY VERSION
STRUCTURED WITHOUT REDUNDANCY VERSION

Static methods question

- Write a program to print these figures using methods.

```
   ______
  /      \
 /        \
 \        /
  \______/

 \        /
  \______/
+--------+

   ______
  /      \
 /        \
 |  STOP  |
 \        /
  \______/

   ______
  /      \
 /        \
+--------+
```

Development strategy

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```
   ______
  /      \
 /        \
 \        /
  \______/

 \        /
  \______/
+--------+

   ______
  /      \
 /        \
|   STOP   |
 \        /
  \______/

   ______
  /      \
 /        \
+--------+
```

<u>First version (unstructured):</u>

- Create an empty program and `main` method.
- Copy the expected output into it, surrounding each line with `System.out.println` syntax.
- Run it to verify the output.

Program version 1

```
public class Figures1 {
    public static void main(String[] args) {
        System.out.println("  ______");
        System.out.println(" /      \\");
        System.out.println("/        \\");
        System.out.println("\\        /");
        System.out.println(" \\______/");
        System.out.println();
        System.out.println("\\        /");
        System.out.println(" \\______/");
        System.out.println("+--------+");
        System.out.println();
        System.out.println("  ______");
        System.out.println(" /      \\");
        System.out.println("/        \\");
        System.out.println("|  STOP  |");
        System.out.println("\\        /");
        System.out.println(" \\______/");
        System.out.println();
        System.out.println("  ______");
        System.out.println(" /      \\");
        System.out.println("/        \\");
        System.out.println("+--------+");
    }
}
```

Development strategy 2

```
  ______
 /      \
/        \
\        /
 \______/

\        /
 \______/
+--------+

  ______
 /      \
/        \
|  STOP  |
\        /
 \______/

  ______
 /      \
/        \
+--------+
```

Second version (structured, with redundancy):

- Identify the structure of the output.
- Divide the `main` method into static methods based on this structure.

Output structure

```
  _______
 /       \
/         \
\         /
 \_______/
```

```
\         /
 \_______/
+---------+
```

```
  _______
 /       \
/         \
|  STOP   |
\         /
 \_______/
```

```
  _______
 /       \
/         \
+---------+
```

The structure of the output:

- initial "egg" figure
- second "teacup" figure
- third "stop sign" figure
- fourth "hat" figure

This structure can be represented by methods:

- `egg`
- `teaCup`
- `stopSign`
- `hat`

Program version 2

```
public class Figures2 {
    public static void main(String[] args) {
        egg();
        teaCup();
        stopSign();
        hat();
    }

    public static void egg() {
        System.out.println("  ______");
        System.out.println(" /      \\");
        System.out.println("/        \\");
        System.out.println("\\        /");
        System.out.println(" \\______/");
        System.out.println();
    }

    public static void teaCup() {
        System.out.println("\\        /");
        System.out.println(" \\______/");
        System.out.println("+--------+");
        System.out.println();
    }
    ...
```

Program version 2, cont'd.

```
    ...

    public static void stopSign() {
        System.out.println("     _______");
        System.out.println("   /         \\");
        System.out.println("/             \\");
        System.out.println("|    STOP     |");
        System.out.println("\\             /");
        System.out.println("   \\_______/");
        System.out.println();
    }

    public static void hat() {
        System.out.println("     _______");
        System.out.println("   /         \\");
        System.out.println("/             \\");
        System.out.println("+-----------+");
    }
}
```

Development strategy 3

CS 210

```
  ______
 /      \
/        \
\        /
 \______/

\        /
 \______/
+--------+

  ______
 /      \
/        \
|  STOP  |
\        /
 \______/

  ______
 /      \
/        \
+--------+
```

Third version (structured, without redundancy):

- Identify redundancy in the output, and create methods to eliminate as much as possible.

- Add comments to the program.

Output redundancy

CS 210

```
  _______
 /       \
/         \
\         /
 \_______/

\         /
 \_______/
+---------+

  _______
 /       \
/         \
|  STOP   |
\         /
 \_______/

  _______
 /       \
/         \
+---------+
```

The redundancy in the output:

▪ egg top:	reused on stop sign, hat
▪ egg bottom:	reused on teacup, stop sign
▪ divider line:	used on teacup, hat

This redundancy can be fixed by methods:

- `eggTop`
- `eggBottom`
- `line`

Program version 3

```
// Suzy Student, CSE 138, Spring 2094
// Prints several figures, with methods for structure and redundancy.
public class Figures3 {
    public static void main(String[] args) {
        egg();
        teaCup();
        stopSign();
        hat();
    }

    // Draws the top half of an an egg figure.
    public static void eggTop() {
        System.out.println("  ______");
        System.out.println(" /      \\");
        System.out.println("/        \\");
    }

    // Draws the bottom half of an egg figure.
    public static void eggBottom() {
        System.out.println("\\        /");
        System.out.println(" \\______/");
    }

    // Draws a complete egg figure.
    public static void egg() {
        eggTop();
        eggBottom();
        System.out.println();
    }

    ...
```

Program version 3, cont'd.

```
    ...
    // Draws a teacup figure.
    public static void teaCup() {
        eggBottom();
        line();
        System.out.println();
    }

    // Draws a stop sign figure.
    public static void stopSign() {
        eggTop();
        System.out.println("|  STOP  |");
        eggBottom();
        System.out.println();
    }

    // Draws a figure that looks sort of like a hat.
    public static void hat() {
        eggTop();
        line();
    }

    // Draws a line of dashes.
    public static void line() {
        System.out.println("+--------+");
    }
}
```

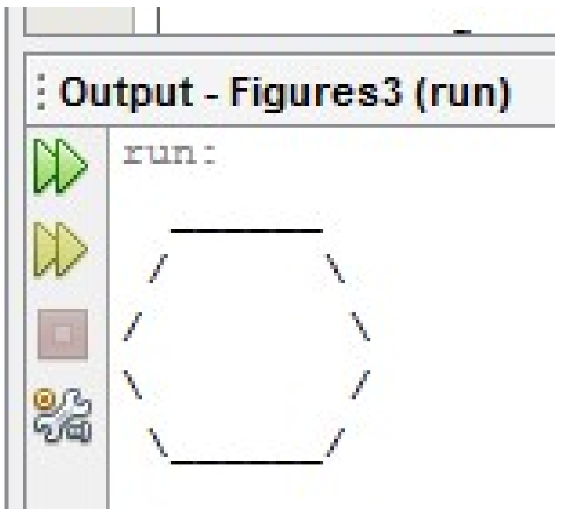
Program version 3 – Implementation Steps

Step 3: Re[illegible] method at a time, keep [illegible] move on…

play Slide Show for better displays

```
// CS 210  Spring 2013 Section OAS
// Student Name
// Prints several figures, with methods for structure and redundancy.

public class Figures3 {
    public static void main(String[] args) {
      // TODO (fill in your                      xact figure as specified
   in the problem
    }
}
    // Draws a complete e
    public static void eg
        eggTop();
        eggBottom();
        System.out.printl
    }
   // Draws the top half of an egg figure.
    public static void eggTop() {
        System.out.println("   ______");
        System.out.println("  /      \\");
        System.out.println("/         \\");
    }
   // Draws the bottom half of an egg figure.
    public static void eggBottom() {
        System.out.println("\\        /");
        System.out.println(" \\______/");
    }
```



```
run:
   ______
  /      \
 /        \
 \        /
  \______/
```

Continue

A word about style

- Structure your code properly
- Eliminate redundant code
- Use spaces judiciously and **consistently**
- Indent properly
- Follow the naming conventions
- Use comments to describe code behavior

Why style?

- Programmers build on top of other's code all the time.
  - You should **NOT** waste time deciphering what a method does.
- You should spend time on thinking or coding.
  - You should **NOT** be wasting time looking for that missing closing brace.
- So CODE WITH STYLE!

The End

CS 210

CHAPTER 1

INTRODUCTION TO JAVA PROGRAMMING

Winnie Li