

Entering the world of Javatar



Subset of the Supplement Lesson slides from: Building Java Programs
by Stuart Reges and Marty Stepp (<http://www.buildingjavaprograms.com/>)

Compiling/running programs

1. Write it.

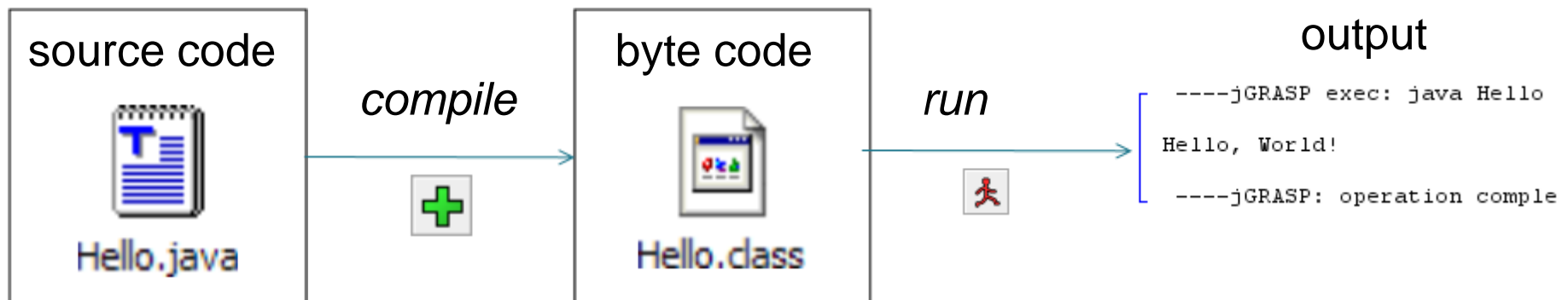
- **code** or **source code**: The set of instructions in a program.

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.



Syntax

- Set of legal structures and commands that can be used in a language
 - Semicolons ;
 - curly braces { }
 - **Identifiers**: names of the commands and such...
- Compiler checks syntax, gives errors

```
Hello.java:3: ';' expected
    System.out.println("Hello, world!!")
                        ^
```

1 error

Names and identifiers

- You must give your program a name.

```
public class SquidInk{
```

- Naming convention: capitalize each word (e.g. MyClassName)
- Your program's file must match exactly (SquidInk)
 - 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	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

- A statement that prints a line of output on the console.
 - pronounced "print-linn"
 - sometimes called a "println statement" for short
 - A newline is included at the end of each println
- 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.

Strings

- Sequence of characters
- Enclosed in double quotes “This is enclosed in double quotes”
- Some special characters must be *escaped* using the backslash: ‘\’
 - For example: \" \t \n \\
 - Double quote: \"
 - Tab: \t
 - Newline: \n

Reality check

- 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:

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


Should you Comment your code?

“Corporate computer programmers spend up to 80% of their time maintaining software.”

- *Managing Information Technology in a Global Society*
edited by Mehdi Khosrowpour

“Always code as if the guy who ends up maintaining your code will be a violent psychopath who knows where you live.”

- Martin Golding



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. */`

Comments

- Use them to explain the tricky bits of your code
- Lets others know what's on your mind
- Use appropriately: if something is not obvious from the syntax, it's best to add a comment
- Can use both flavors: `/* ... */` and `//`

Good:

```
// Prints a greeting
```

Bad:

```
/* This is my super awesome program  
that uses the println statement to go  
ahead and display a friendly message  
to the user because it's a convention  
that was started long ago.*/
```

Static Methods & Decomposition

Subset of the Supplement Lesson slides from: [Building Java Programs](http://www.buildingjavaprograms.com/), Chapter 1
by Stuart Reges and Marty Stepp (<http://www.buildingjavaprograms.com/>)

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 oven temperature
 - 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.

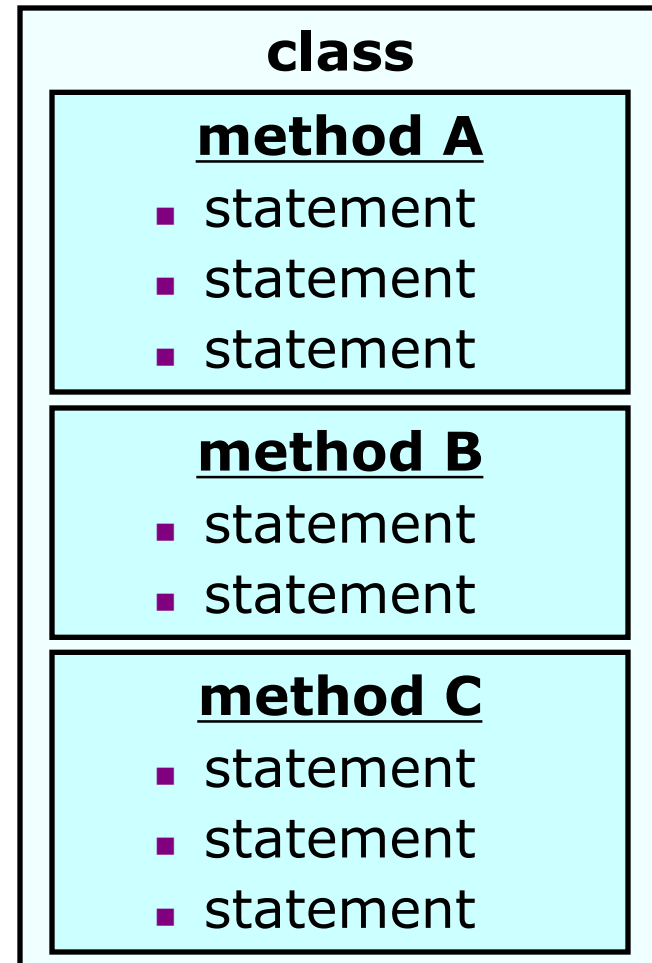
- ...

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.");
    }
}
```

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.

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.");
    }
}
```

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 printWarning() {  
    System.out.println("This product causes cancer");  
    System.out.println("in lab rats and humans.");  
}
```

Calling a method

Executes the method's code

- **Syntax:**

name ();

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

- **Example:**

```
printWarning ();
```

- **Output:**

```
This product causes cancer  
in lab rats and humans.
```

Program with static method

```
public class StartToday20110912 {
    public static void main(String[] args) {

        first();
        cheer();
        first();
        cheer();
        second();
    }

    public static void cheer() {
        System.out.println("G!H!S!");
    }

    public static void first() {
        System.out.println("Y-E-L-L Bulldogs Yell!");
    }

    public static void second() {
        System.out.println("Everybody Screams");
    }
}
```

Output:

```
Y-E-L-L Bulldogs Yell!
G!H!S!
Y-E-L-L Bulldogs Yell!
G!H!S!
Everybody Screams!
```

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.");
    }
}
```


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

- 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("Done with message2.");  
    }  
    ...  
}
```

```
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.");  
}
```

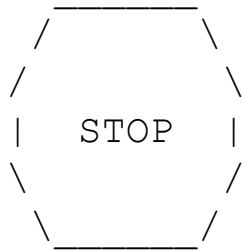
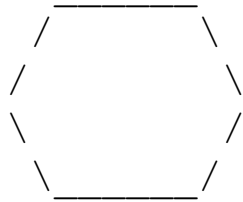
When to use methods

- 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.)

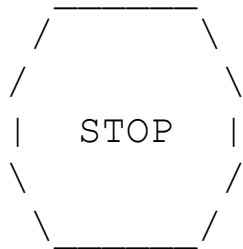
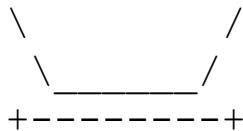
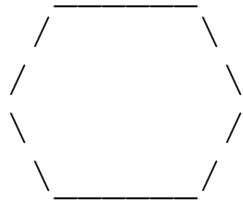
Drawing complex figures with static methods

Static methods question

- Write a program to print these figures using methods.



Development strategy



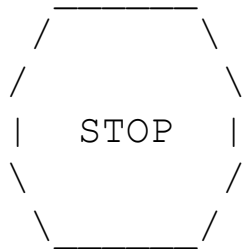
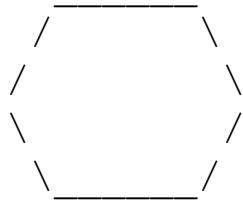
First version (unstructured):

- 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("+-----+");
    }
}
```

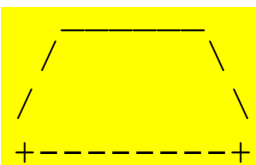
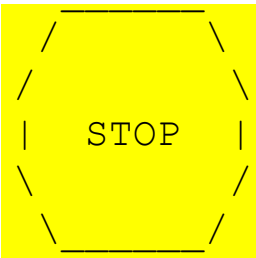
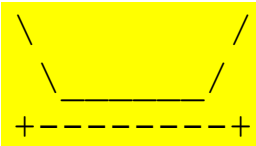
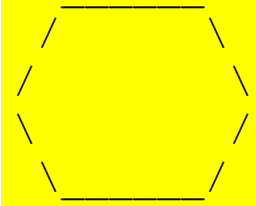
Development strategy 2



Second version (structured, with redundancy):

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

Output structure



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();
    }
    ...
}
```

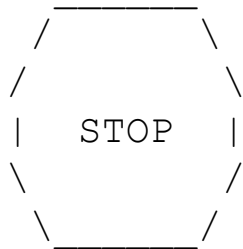
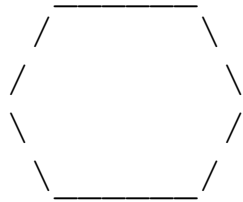
Program version 2, cont'd.

...

```
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("+-----+");
}
}
```

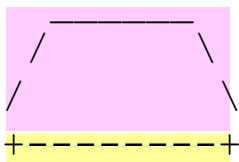
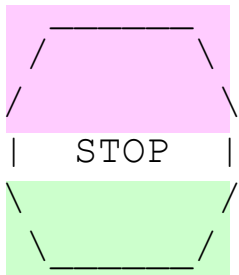
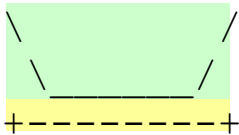
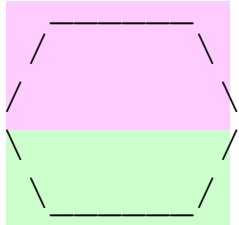
Development strategy 3



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



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("+-----+");
}
}
```