

Topic 7

parameters

"We're flooding people with information. We need to feed it through a processor. A human must turn information into intelligence or knowledge. ***We've tended to forget that no computer will ever ask a new question.***"

— Rear Admiral Grace Murray Hopper "



Redundant recipes

- ▶ Recipe for baking **20** cookies:
 - Mix the following ingredients in a bowl:
 - **4** cups flour
 - **1** cup butter
 - **1** cup sugar
 - **2** eggs
 - **40** oz. chocolate chips ...
 - Place on sheet and Bake for about **10** minutes.

- ▶ Recipe for baking **40** cookies:
 - Mix the following ingredients in a bowl:
 - **8** cups flour
 - **2** cups butter
 - **2** cups sugar
 - **4** eggs
 - **80** oz. chocolate chips ...
 - Place on sheet and Bake for about **10** minutes.

Parameterized recipe

- ▶ Recipe for baking **20** cookies:
 - Mix the following ingredients in a bowl:
 - 4 cups flour
 - 1 cup sugar
 - 2 eggs
 - ...

- ▶ Recipe for baking **N** cookies:
 - Mix the following ingredients in a bowl:
 - **N/5** cups flour
 - **N/20** cups butter
 - **N/20** cups sugar
 - **N/10** eggs
 - **2N** oz. chocolate chips ...
 - Place on sheet and Bake for about 10 minutes.

- ▶ **parameter**: A value that distinguishes similar tasks.

Redundant figures

- ▶ Consider the task of printing the following lines/boxes:

* * * * * * * * * * * * * *

* * * * * * *

* *

* * * * * * * * * *

* * * * * *

* * * * * * * * * *

* * * * *

* * *

* * *

* * * * *

A redundant solution

```
public class Stars1 {
    public static void main(String[] args) {
        lineOf13();
        lineOf7();
        lineOf35();
        box10x3();
        box5x4();
    }

    public static void lineOf13() {
        for (int i = 1; i <= 13; i++) {
            System.out.print("*");
        }
        System.out.println();
    }

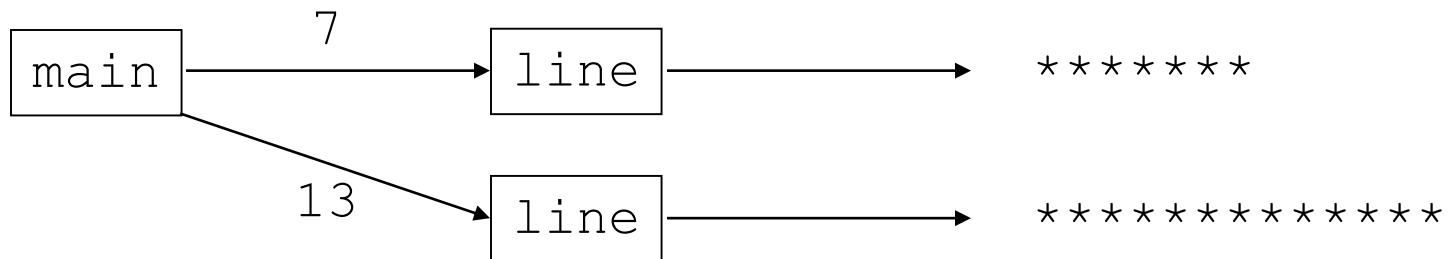
    public static void lineOf7() {
        for (int i = 1; i <= 7; i++) {
            System.out.print("*");
        }
        System.out.println();
    }

    public static void lineOf35() {
        for (int i = 1; i <= 35; i++) {
            System.out.print("*");
        }
        System.out.println();
    }
    ...
}
```

- This code is redundant.
- Would variables help?
Would constants help?
- What is a better solution?
 - `line` - A method to draw a line of any number of stars.
 - `box` - A method to draw a box of any size.

Parameterization

- ▶ **parameter:** A value passed to a method by its caller.
 - Instead of `lineOf7`, `lineOf13`, **write** `line` to draw any length.
 - When *declaring* the method, we will state that it requires a parameter for the number of stars.
 - When *calling* the method, we will specify how many stars to draw.



Declaring a parameter

Stating that a method requires a parameter in order to run

```
public static void <name> (<type> <name>) {  
    <statement>(s);  
}
```

▶ Example:

```
public static void sayPassword(int code) {  
    System.out.println("The password is: " + code);  
}
```

- When `sayPassword` is called, the caller must specify the integer `code` to print.

Passing a parameter

Calling a method and specifying values for its parameters

<name> (<expression>) ;

▶ Example:

```
public static void main(String[] args) {  
    sayPassword(42) ;  
    sayPassword(12345) ;  
}
```

Output:

The password is 42

The password is 12345

Parameters and loops

- ▶ A parameter can guide the number of repetitions of a loop.

```
public static void main(String[] args) {  
    chant(3);  
}
```

```
public static void chant(int times) {  
    for (int i = 1; i <= times; i++) {  
        System.out.println("Just a salad...");  
    }  
}
```

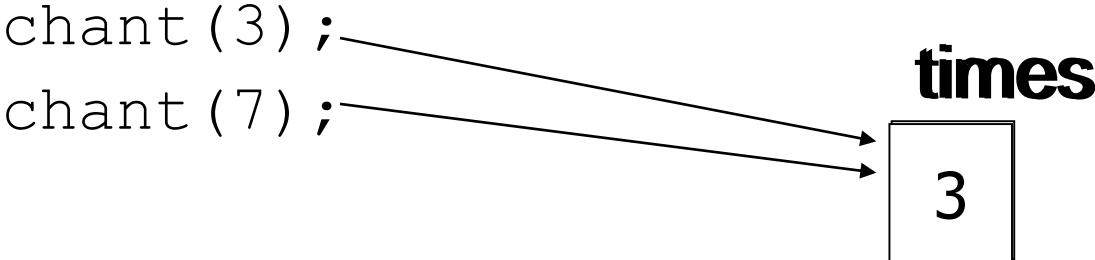
Output:

```
Just a salad...  
Just a salad...  
Just a salad...
```

How parameters are passed

- ▶ When the method is called:
 - The value is stored into the parameter variable.
 - The method's code executes using that value.

```
public static void main(String[] args) {  
    chant(3);  
    chant(7);  
}
```



The diagram illustrates the passing of the value 3 to the parameter variable 'times'. Two arrows originate from the '3' in the first and second lines of the main method, pointing to a rectangular box labeled 'times' which contains the number 3.

```
public static void chant(int times) {  
    for (int i = 1; i <= times; i++) {  
        System.out.println("Just a salad...");  
    }  
}
```

Common errors

- ▶ If a method accepts a parameter, it is illegal to call it without passing any value for that parameter.

```
chant(); // ERROR: parameter value required
```

- ▶ The value passed to a method must be of the correct type.

```
chant(3.7); // ERROR: must be of type int
```

- ▶ Exercise: Change the `Stars` program to use a parameterized method for drawing lines of stars.

Stars solution

```
// Prints several lines of stars.  
// Uses a parameterized method to remove redundancy.  
public class Stars2 {  
    public static void main(String[] args) {  
        line(13);  
        line(7);  
        line(35);  
    }  
  
    // Prints the given number of stars plus a line break.  
    public static void line(int count) {  
        for (int i = 1; i <= count; i++) {  
            System.out.print("*");  
        }  
        System.out.println();  
    }  
}
```

Multiple parameters

- ▶ A method can accept multiple parameters.
(separate with ,)
 - When calling it, you **must** pass values for each parameter.

- ▶ Declaration:

```
public static void <name>(<type> <name>, ..., <type> <name>) {  
    <statement>(s);  
}
```

- ▶ Call:

```
<name> (<exp>, <exp>, ..., <exp>) ;
```

Multiple parameters example

```
public static void main(String[] args) {  
    printNumber(4, 9);  
    printNumber(17, 6);  
    printNumber(8, 0);  
    printNumber(0, 8);  
}  
  
public static void printNumber(int number, int count) {  
    for (int i = 1; i <= count; i++) {  
        System.out.print(number);  
    }  
    System.out.println();  
}
```

Output:

```
444444444  
171717171717
```

```
00000000
```

- ▶ Modify the `Stars` program to draw boxes with parameters.

Stars solution

```
// Prints several lines and boxes made of stars.  
// Third version with multiple parameterized methods.
```

```
public class Stars3 {  
    public static void main(String[] args) {  
        line(13);  
        line(7);  
        line(35);  
        System.out.println();  
        box(10, 3);  
        box(5, 4);  
        box(20, 7);  
    }  
  
    // Prints the given number of stars plus a line break.  
    public static void line(int count) {  
        for (int i = 1; i <= count; i++) {  
            System.out.print("*");  
        }  
        System.out.println();  
    }  
    ...  
}
```

Stars solution, cont'd.

...

```
// Prints a box of stars of the given size.
public static void box(int width, int height) {
    line(width);

    for (int line = 1; line <= height - 2; line++) {
        System.out.print("*");
        for (int space = 1; space <= width - 2; space++) {
            System.out.print(" ");
        }
        System.out.println("*");
    }

    line(width);
}
}
```


Value semantics

- ▶ **value semantics:** When primitive variables (`int`, `double`) are passed as parameters, their values are copied.
 - Modifying the parameter will not affect the variable passed in.

```
public static void strange(int x) {  
    x = x + 1;  
    System.out.println("1. x = " + x);  
}
```

```
public static void main(String[] args) {  
    int x = 23;  
    strange(x);  
    System.out.println("2. x = " + x);  
    ...  
}
```

Output:

```
1. x = 24  
2. x = 23
```

Clicker 1 - Output of "Parameter Mystery"

```
public class ParameterMystery {  
    public static void main(String[] args) {  
        int x = 9;  
        int y = 2;  
        int z = 5;  
  
        mystery(z, y, x);  
  
        mystery(y, x, z);  
    }  
  
    public static void mystery(int x, int z, int y) {  
        System.out.print(z + " " + (y - x) + " ");  
    }  
}
```

A. 5 -7 5 -7

B. 9 -3 5 7

C. 2 4 9 3

D. 9 -3 5 12

E. None of A through D

Clicker 2 - What is output by the following code?

```
int x = 2;
int y = 5;
mystery2(x, y);
System.out.print(x + " " + y + " ");

public static void mystery2(int x, int y) {
    System.out.print(x + " " + y + " ");
    x *= y + 3;
    y--;
    x++;
    System.out.print(x + " " + y + " ");
}
```

A. 2 5 17 4 2 5

B. 2 5 17 4 17 4

C. 17 4 2 5 17 4

D. 2 5 2 5 17 4

E. None of A through D

Recall: Strings

- ▶ **string**: A sequence of text characters.

```
String <name> = "<text>";
```

```
String <name> = <expression resulting in  
String>;
```

- Examples:

```
String name = "Marla Singer";
```

```
int x = 3;
```

```
int y = 5;
```

```
String point = "(" + x + ", " + y + ")";
```

Clicker 3

▶ Are Strings a primitive data type just like `int` and `double`?

A. No

B. Yes

Strings as parameters

```
public class StringParameters {
    public static void main(String[] args) {
        sayHello("Marty");
        String teacher = "Bictolia";
        sayHello(teacher);
    }
    public static void sayHello(String name) {
        System.out.println("Welcome, " + name);
    }
}
```

Output:

```
Welcome, Marty
Welcome, Bictolia
```

- ▶ Modify the `Stars` program to use string parameters. Use a method named `repeat` that prints a string many times.

Stars solution

```
// Prints several lines and boxes made of stars.  
// Fourth version with String parameters.
```

```
public class Stars4 {  
    public static void main(String[] args) {  
        line(13);  
        line(7);  
        line(35);  
        System.out.println();  
        box(10, 3);  
        box(5, 4);  
        box(20, 7);  
    }  
  
    // Prints the given number of stars plus a line break.  
    public static void line(int count) {  
        repeat("*", count);  
        System.out.println();  
    }  
  
    ...  
}
```

Stars solution, cont'd.

...

```
// Prints a box of stars of the given size.
```

```
public static void box(int width, int height) {  
    line(width);  
  
    for (int line = 1; line <= height - 2; line++) {  
        System.out.print("*");  
        repeat(" ", width - 2);  
        System.out.println("*");  
    }  
  
    line(width);  
}
```

```
// Prints the given String the given number of times.
```

```
public static void repeat(String s, int times) {  
    for (int i = 1; i <= times; i++) {  
        System.out.print(s);  
    }  
}
```