

6.092: Intro to Java

3: Loops, Arrays

Assignment 2

Foo Corporation needs a program to calculate how much to pay their employees.

1. $\text{Pay} = \text{hours worked} \times \text{base pay}$
2. Hours over 40 get paid 1.5 the base pay
3. The base pay must be no less than \$8.00
4. The number of hours must be no more than 60

Frequent Issues (I)

The signature of the *main* method *cannot* be modified.

```
public static void main(String[] arguments) {  
    ...  
}
```

Frequent Issues (II)

Return values: if you declare that the method is not *void*, then it has to return something!

```
public static int pay(double basePay, int hours) {  
    if (basePay < 8.0)    return -1;  
    else if (hours > 60) return -1;  
    else {  
        int salary = 0;  
        ...  
        return salary  
    }  
}
```

Frequent Issues (III)

Don't create duplicate variables with the same name

```
public static int pay(double basePay, int hours) {  
    int salary = 0;    // OK  
    ...  
    int salary = 0;    // salary already defined!!  
    ...  
    double salary = 0; //salary already defined!!  
    ...  
}
```

```
class WeeklyPay {  
  
    public static void pay(double basePay, int hours) {  
  
        if (basePay < 8.0) {  
            System.out.println("You must be paid at least $8.00/hour");  
        } else if (hours > 60) {  
            System.out.println("You can't work more than 60 hours a week");  
        } else {  
            int overtimeHours = 0;  
            if (hours > 40) {  
                overtimeHours = hours - 40;  
                hours = 40;  
            }  
            double pay = basePay * hours;  
            pay += overtimeHours * basePay * 1.5;  
            System.out.println("Pay this employee $" + pay);  
        }  
    }  
  
    public static void main(String[] arguments) {  
        pay(7.5, 35);  
        pay(8.2, 47);  
        pay(10.0, 73);  
    }  
}
```

What we have learned so far

- Variables & types
- Operators
- Type conversions & casting
- Methods & parameters
- *If* statement

Today's Topics

- Good programming style
- Loops
- Arrays

Good Programming Style

Good programming style

The goal of good style is to make your
code more readable.

By you and by others.

Rule #1: use good (meaningful) names

```
String a1;  
int a2;  
double b; // BAD!!  
  
String firstName; // GOOD  
String lastName; // GOOD  
int temperature; // GOOD
```

Rule #2: Use indentation

```
public static void main (String[] arguments) {  
    int x = 5;  
    x = x * x;  
    if (x > 20) {  
        System.out.println(x + " is greater than 20.");  
    }  
    double y = 3.4;  
}
```

Have a demo with no indentation

Ctrl-shift-F to auto-format the file

Rule #3: Use whitespaces

Put whitespaces in complex expressions:

// BAD!!

```
double cel=fahr*42.0/(13.0-7.0);
```

// GOOD

```
double cel = fahr * 42.0 / (13.0 - 7.0);
```

Rule #3: Use whitespaces

Put blank lines to improve readability:

```
public static void main (String[] arguments) {  
  
    int x = 5;  
    x = x * x;  
  
    if (x > 20) {  
        System.out.println(x + " is > 20.");  
    }  
  
    double y = 3.4;  
}
```

Rule #4: Do not duplicate tests

```
if (basePay < 8.0) {  
    ...  
} else if (hours > 60) {  
    ...  
} else if (basePay >= 8.0 && hours <= 60) {  
    ...  
}
```

Rule #4: Do not duplicate tests

```
if (basePay < 8.0) {  
    ...  
} else if (hours > 60) {  
    ...  
} else if (basePay >= 8.0 && hours <= 60) {  
    ...  
}
```

BAD

Rule #4: Do not duplicate tests

```
if (basePay < 8.0) {  
    ...  
} else if (hours > 60) {  
    ...  
} else {  
    ...  
}
```

Good programming style (summary)

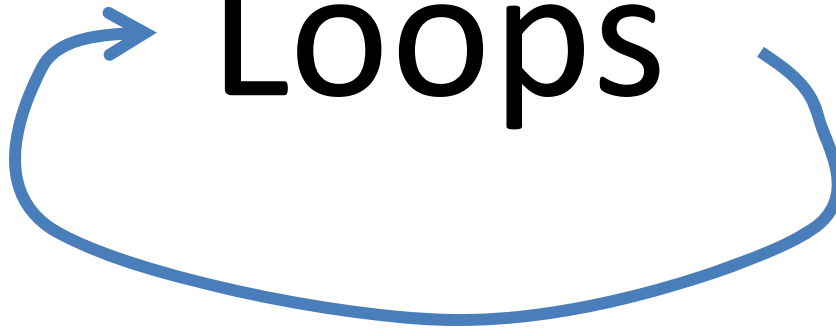
Use good names for variables and methods

Use indentation

Add whitespaces

Don't duplicate tests

Loops



Loops

```
static void main (String[] arguments) {  
    System.out.println("Rule #1");  
    System.out.println("Rule #2");  
    System.out.println("Rule #3");  
}
```

What if you want to do it for 200 Rules?

Loops

Loop operators allow to loop through a block of code.

There are several loop operators in Java.

The *while* operator

```
while (condition) {  
    statements  
}
```

The *while* operator

```
int i = 0;
while (i < 3) {
    System.out.println("Rule #" + i);
    i = i+1;
}
```

Count carefully

Make sure that your loop has a chance to finish.

The *for* operator

```
for (initialization; condition; update) {  
    statements  
}
```


The *for* operator

```
for (int i = 0; i < 3; i=i+1) {  
    System.out.println("Rule #" + i);  
}
```

Note: `i = i+1` may be replaced by `i++`

Branching Statements

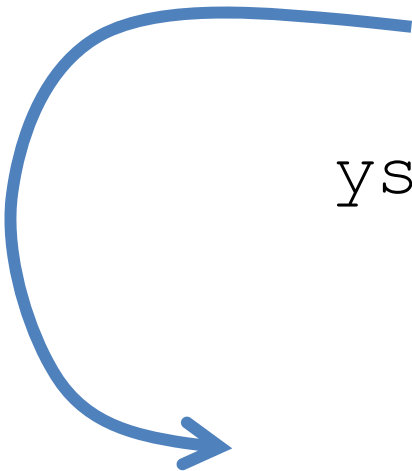
break terminates a *for* or *while* loop

```
for (int i=0; i<100; i++) {
```

```
    if (i == 50)
```

```
        break;
```

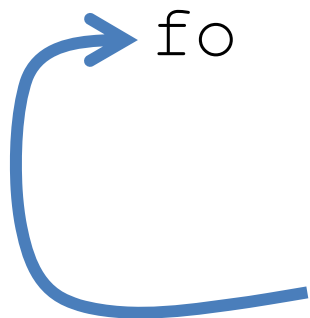
```
    system.out.println("Rule #" + i);
```



Branching Statements

continue skips the current iteration of a loop and proceeds directly to the next iteration

```
for (int i=0; i<100; i++) {  
    if (i == 50)  
        continue;  
    System.out.println("Rule #" + i);  
}
```



Embedded loops

```
for (int i = 0; i < 3; i++) {  
    for (int j = 2; j < 4; j++) {  
        System.out.println (i + " " + j);  
    }  
}
```

Scope of the variable defined in the initialization:
respective *for* block

Arrays

Arrays

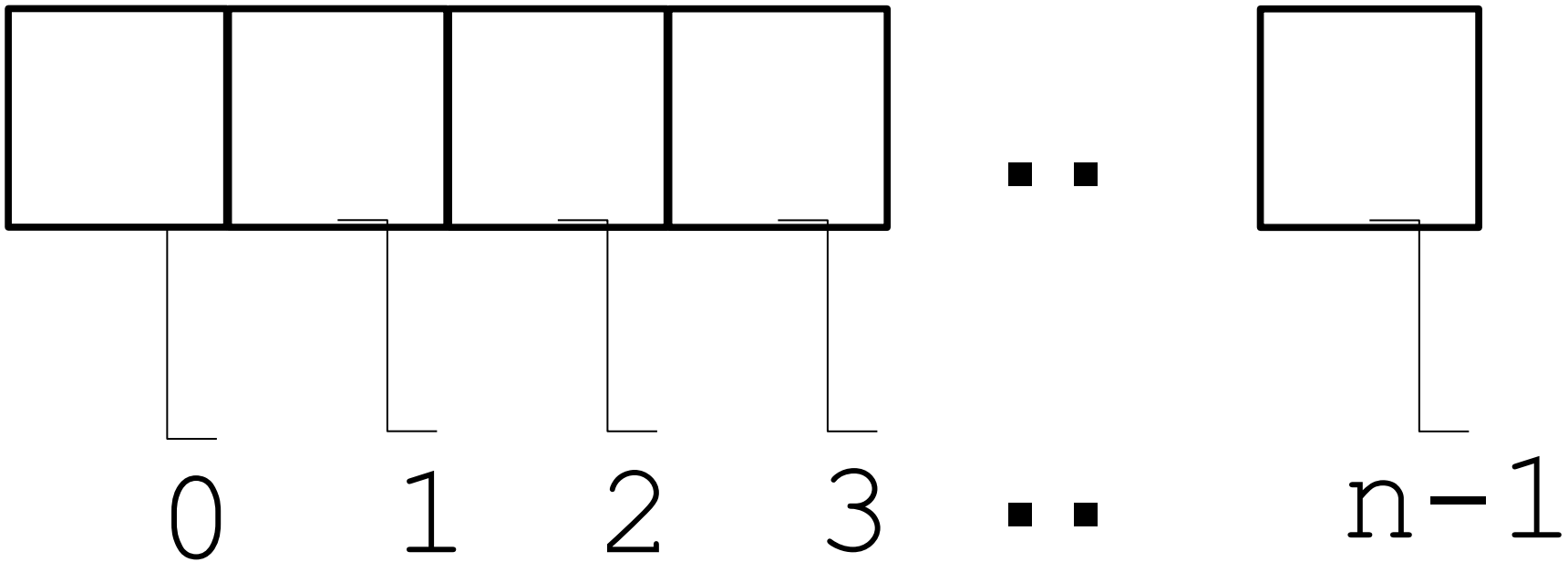
An array is an indexed list of values.

You can make an array of any type

int, double, String, etc..

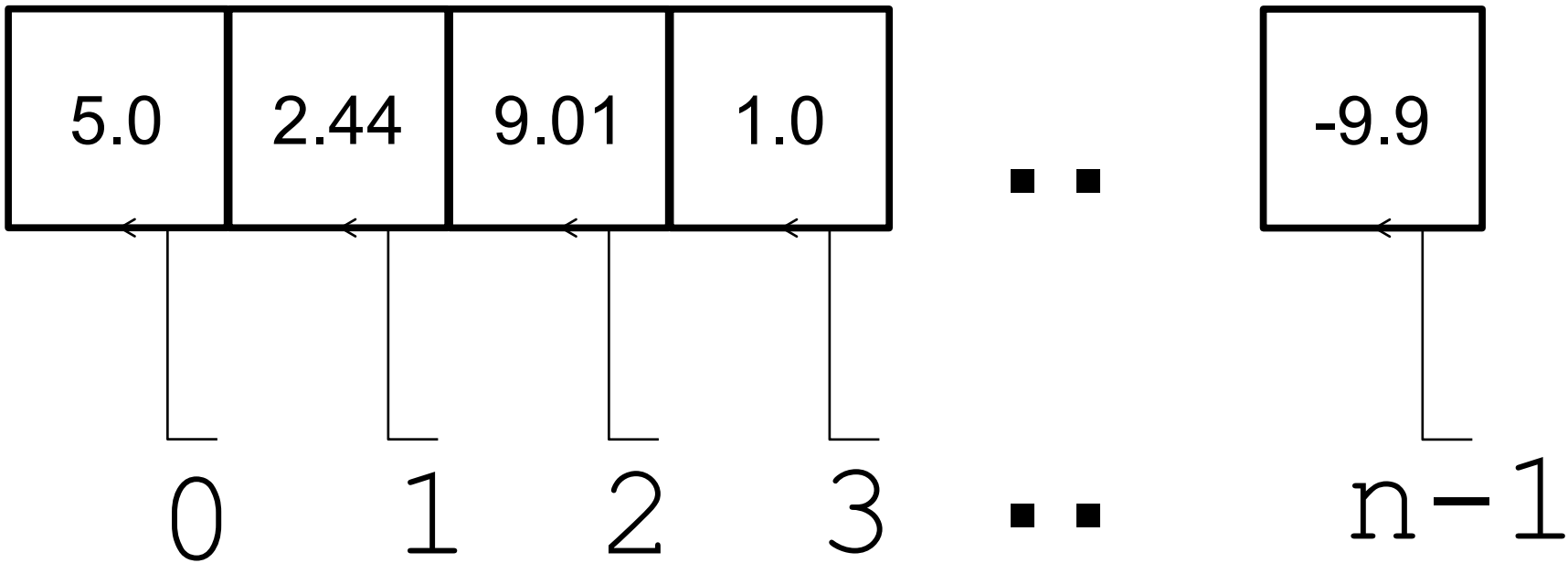
All elements of an array must have the same type.

Arrays



Arrays

Example: double []



Arrays

The index starts at zero and ends at length-1.

Example:

```
int[] values = new int[5];  
values[0] = 12; // CORRECT  
values[4] = 12; // CORRECT  
values[5] = 12; // WRONG!! compiles but  
                // throws an Exception  
                // at run-time
```

Have a demo with runtime exception

Arrays

An array is defined using TYPE `[]`.

Arrays are just another type.

```
int[] values; // array of int
```

```
int[][] values; // int[] is a type
```

Arrays

To create an array of a given size, use the operator `new` :

```
int[] values = new int[5];
```

or you may use a variable to specify the size:

```
int size = 12;
```

```
int[] values = new int[size];
```

Array Initialization

Curly braces can be used to initialize an array.

It can **ONLY** be used when you declare the variable.

```
int[] values = { 12, 24, -23, 47 };
```

Quiz time!

Is there an error in this code?

```
int[] values = {1, 2.5, 3, 3.5, 4};
```

Accessing Arrays

To access the elements of an array, use the `[]` operator:

```
values[index]
```

Example:

```
int[] values = { 12, 24, -23, 47 };  
values[3] = 18; // {12, 24, -23, 18}  
int x = values[1] + 3; // {12, 24, -23, 18}
```

The *length* variable

Each array has a `length` variable built-in that contains the length of the array.

```
int[] values = new int[12];  
int size = values.length; // 12
```

```
int[] values2 = {1, 2, 3, 4, 5}  
int size2 = values2.length; // 5
```

String arrays

A side note

```
public static void main (String[] arguments) {  
    System.out.println (arguments.length) ;  
    System.out.println (arguments [0]) ;  
    System.out.println (arguments [1]) ;  
}
```


Combining Loops and Arrays

Looping through an array

Example 1:

```
int[] values = new int[5];

for (int i=0; i<values.length; i++) {
    values[i] = i;
    int y = values[i] * values[i];
    System.out.println(y);
}
```

Looping through an array

Example 2:

```
int[] values = new int[5];
int i = 0;
while (i < values.length) {
    values[i] = i;
    int y = values[i] * values[i];
    System.out.println(y);
    i++;
}
```

Summary for today

1. Programming Style
2. Loops
3. Arrays

Assignment 3

A group of friends participate in the Boston Marathon.

Find the best performer.

Find the second-best performer.

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