204700
Data Structure and Programming Languages

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3.LOOPS AND ARRAYS

Assignment 3

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

1. Pay = hours worked x 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

Outline

- 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 a3;                    //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 > 20.");
    }
    double y = 3.4;
}
```

Eclipse uses 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 {
        …
}
```

Good programming style (summary)

Use good names for variables and methods

Use indentation

Add whitespaces

Don’t duplicate tests

LOOPS

Loops

```
public 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);
}
```

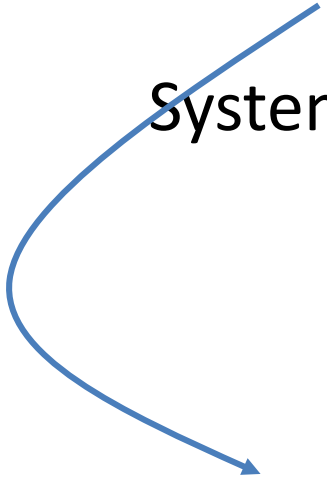
Note: i = i+1 may be replaced by i++

```
Rule #0
Rule #1
Rule #2
```

Branching Statements

break terminates a for loop or while loop

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

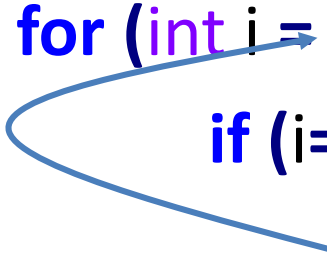


```
……
Rule #43
Rule #44
Rule #45
Rule #46
Rule #47
Rule #48
Rule #49
```

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);
}
```



```
…
Rule #46
Rule #47
Rule #48
Rule #49
Rule #51
Rule #52
Rule #53
…
```

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

```
0 2
0 3
1 2
1 3
2 2
2 3
```

- Assignment 4_1

ARRAYS

Arrays

An array is an indexed **list** of values.

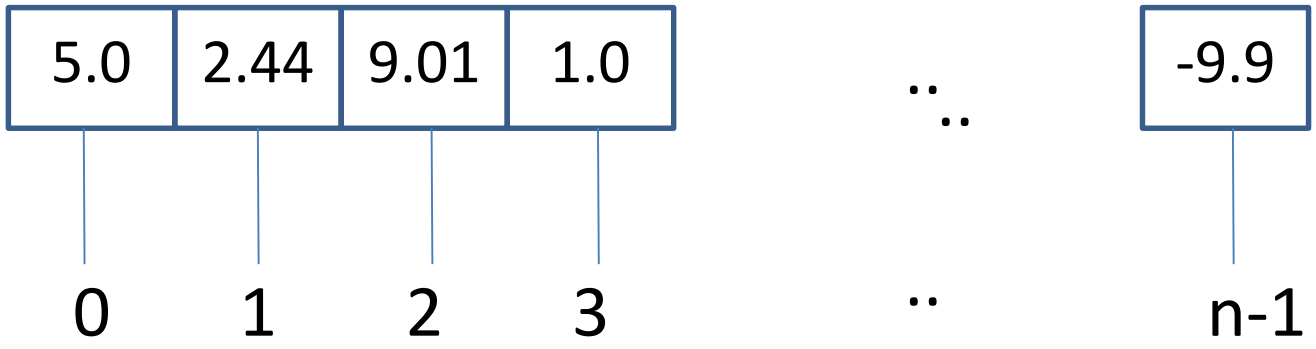
You can make an array of any type

int, double, String, etc..

All elements of an array must have the same type.

Arrays

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
```

Arrays

An array is defined using TYPE[].

Array 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:

value[index]

Example:

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

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 =     {11,12,13,14,15};
int size2 =         values2.length    //5
```

String arrays

```
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

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);
}
```

Combining Loops and Arrays

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 4_2

A group of friends participate in the Boston Marathon.

Find the best performance.

Find the second-best performance.

Homework

- Assignment 4_3