Return Values

Method Return Values

Parameters passed to methods are not changed.
What is the output of the code below?

```
int x = 5;

example(x);
System.out.println(x);

void example(int x) {
    x = x + 1;
    System.out.println(x);
}
```

Method Return Values

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    System.out.println(x);
}
```

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Method Return Values

You can return any data type (including objects) from a method.

```
int x = 5;
x = example(x);

int y = example(121);


int example(int x) {
    x = x + 1;

    return x;
}
```

Method Return Values

You can return any data type (including objects) from a method.

```
Student billy = createStudent();


Student createStudent() {
    Student s = new Student();
    s.totalGrade = 0;
    s.year = 1;
    s.generateID();

    return s;
}
```

Method Return Values

Objects have an interesting behavior.
What is the output of the code below?

```
Team x = new Team("Justice League");

example(x);

System.out.println(x.name);


void example(Team t) {
    t.name = "Avengers";
}
```

Method Return Values

Objects have an interesting behavior.
What is the output of the code below?

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Method Return Values

Objects have an interesting behavior.
What is the output of the code below?

```
Team x = new Team("Justice League");

x = example(x);

System.out.println(x.name);


Team example(Team t) {
    t = new Team("Avengers");
    return t;
}
```

Method Return Values

Methods may have several input parameters, but they can only return one value.

```
int a = distance(5, 10, 6);
```

```
int distance(int x, int y, int z) {
    return Math.sqrt((x * x) + (y * y) + (z * z));
}
```

Method Return Values

However, you can overload a method to have a different return value.

```
int a = distance(5, 10, 6);
double b = distance(3.2, 5.2, 8.7);

int distance(int x, int y, int z) {
    return Math.sqrt((x * x) + (y * y) + (z * z));
}

double distance(double x, double y, double z) {
    return Math.sqrt((x * x) + (y * y) + (z * z));
}
```

```
// No! Will not compile! Must be different parameters!
double distance(int x, int y, int z) {
    return (double)Math.sqrt((x * x) + (y * y) + (z * z));
}
```

Variable Scope

Variable Scope

Variables inside a method are only accessible inside that method.

```
public class Student {

    void startHere() {
        doSomething();
        System.out.println(x); // Will not compile!
    }

    void doSomething() {
        int x = 5;
        x = x + x;
        System.out.println(x);
    }
}
```

Variable Scope

Class properties can be accessed by all methods inside the class.

```
public class Student {
    // Properties
    private String name;

    // Methods
    void startHere() {
        doSomething();
        System.out.println(name);
    }

    void doSomething() {
        name = "(unknown)";
    }
}
```

static properties and methods

static

When using the Math class, you may have noticed we did not instantiate it with new. We were able to access a property such as Math.PI as well as Math.sqrt. That is because these were declared as static.

When we instantiate a class, each object has its own copies of the properties and the methods operate on those copies of the properties.

```
Student s1 = new Student("Billy");
Student s2 = new Student("Sally");

s1.addScore(80.0);
s2.addScore(90.0);
```

static

A static property is created only once per program execution and is shared by all instances of your class.

```
public class Student {
    public static int nextId = 100;

    private int myId;
    private String name;

    public Student(string n) {
        myId = nextId++;
        name = n;
    }
}
```

static

What is the output of the code below (assume the first id is 100):

```
Student s1 = new Student("Billy");
Student s2 = new Student("Sally");



System.out.println(s1.getId());
System.out.println(s2.getId());


System.out.println(Student.nextId);
```

static

We can also create static methods. Static methods can access static properties. Because they are not part of an instantiated class, they do not have their own copies of properties.

```
public class Student {
    public static int nextId = 100;

    private int myId;
    private String name;

    public static void doSomething() {
        nextId = nextId + 5;      // OK!
        name = "Voldemort;        // Will not compile!
    }
}
```

static

Static methods can be used without using new.

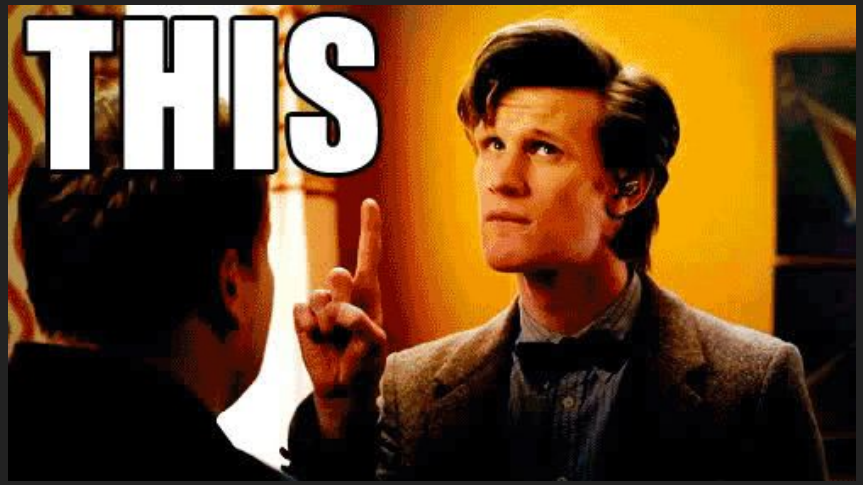
```
Student.doSomething();
```

```
Student s1 = new Student();
s1.setName("Ron");
```

Let’s Code

Don’t Forget!

Check the syllabus / schedule for reading assignments and due dates!


THIS

this

To avoid confusion (and errors) you can use the this keyword to explicitly state that you are referring to the current copy of an object.

```
// OK!
public void setName(String name) {
    this.name = name;
}
```

```
// Has no effect!
public void setName(String name) {
    name = name;
}
```

this

You can not use this in a static method! This is due to the static method not being part of an instance of a class.

```
public class Student {
    private String name;

    public static void doSomething() {
        this.name = "(unknown)";  // Will not compile!
    }
}
```

Derived Classes and Inheritance

Derived Classes

When designing your programs, some objects may be mostly the same but have some variations. You may want to put every variable and method you may ever need all into one large class. (don't do this)

```
public class Shape {
    String name;
    int length;
    int width;
    int height;
    int radius;
    int diameter;
    int sides;

    // ...
}
```

Derived Classes

Instead, think about what many of your objects share and then you can derive a new class from your base class.

```
public class Shape {
    String name;
    int sides;

    // ...
}
```

```
public class Square extends Shape {
    int length;

    // ...
}

public class Rectangle extends Shape {
    int length;
    int width;

    // ...
}
```

Derived Classes

Subclasses can access public variables and methods in the superclass.

```
public class Shape {
    public String name;

    public void printName() {
        System.out.println(name);
    }
}
```

```
public class Square extends Shape
{

    public Square() {
        name = "square";
    }
}
```

```
Square sq = new Square();
sq.printName();
```

```
Output:
square
```

Derived Classes

You can declare a variable as protected to make it only available within a class and its subclasses.

```
// Will not compile!

public class Shape {
    private String name;
}

public class Square extends Shape {

    public Square() {
        name = "square";
    }
}
```

```
// Works!

public class Shape {
    protected String name;
}

public class Square extends Shape {

    public Square() {
        name = "square";
    }
}
```

Overriding

Overriding

You can override a method in the base class by using the @Override annotation.

```
public class Shape {
    public void draw() {
    }
}
```

```
public class Square extends Shape {

    @Override
    public void draw() {
        // Draws a square
    }
}

public class Circle extends Shape {

    @Override
    public void draw() {
        // Draws a Circle
    }
}
```

Overriding

The power in this is being able to have an array of the base class and then have the related method be called.

```
Shape shapes[] = new Shape[4];

shapes[0] = new Circle();
shapes[1] = new Square();
shapes[2] = new Rectangle();
shapes[3] = new Rectangle();



for (int i = 0; i < shapes.length; i++) {
    shapes[i].draw();    // Check this out!
}
```

Let’s Code

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