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Java Foundations

7-3
Constructors

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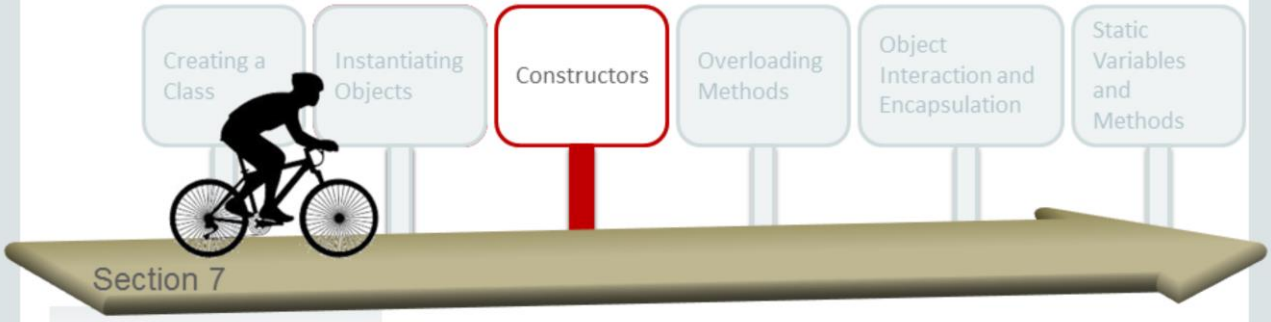
Objectives

This lesson covers the following objectives:

- Understand default values
- Crash the program with a `null` reference
- Understand the default constructor
- Write a constructor that accepts arguments
- Initialize fields with a constructor
- Use `this` as an object reference

Topics

- Default Values
- Using Methods to Set Fields
- Constructors
- The `this` Keyword



Remember the `Prisoner` Class

- It may have looked like this code.
- It contains fields and methods.

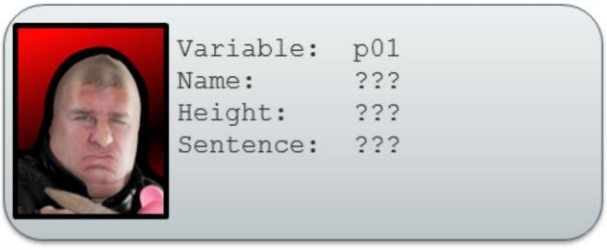
```
public class Prisoner {
    //Fields
    public String name;
    public double height;
    public int sentence;

    //Methods
    public void think(){
        System.out.println("I'll have my revenge.");
    }
}
```

Fields Are Variables

- Variables hold values.
- The values can be accessed.
- Code may need to access variables to …
  - Make calculations
  - Check current values
  - Change a value
- What might happen if a field is accessed before it's assigned a value?

Exercise 1

- Continue editing with the `PrisonTest` project.
  - A version of this program is provided for you.
- Investigate what happens when fields are accessed before they're assigned values.
  - Instantiate a `Prisoner`.
  - Try printing the value of each field.



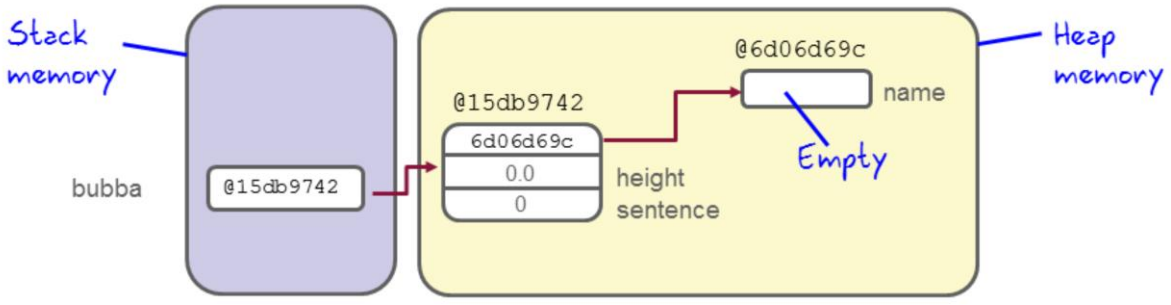
Accessing Uninitialized Fields

- If fields aren't initialized, they take on a **default value.**
- Java provides the following default values:

Data Type	Default Value
`boolean`	`false`
`int`	`0`
`double`	`0.0`
`String`	`null`
Any Object type	`null`

Null Object References

- Objects can have a `null` value.
- A null object points to an empty location in memory
- If an Object has another Object as a field (such as a `String`), its default value is `null`.



Accessing Null Objects Is Dangerous

- What if a null object contains a field or method that needs to be accessed?
  - This causes the program to crash!
  - The specific error is a `NullPointerException`.

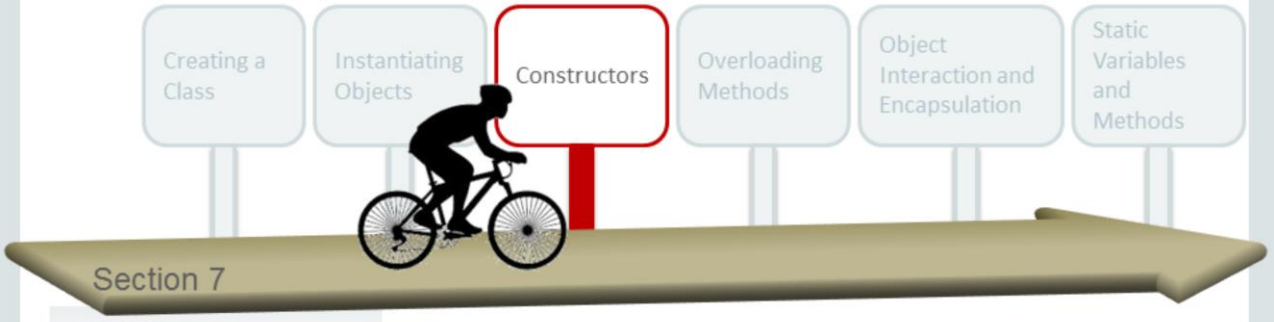
```
public static void main(String[] args){
    String test = null;
    System.out.println(test.length());
}
```

The Importance of Initializing Fields

- It's always good to minimize the chances that your program will crash.
- And sometimes, Java's default values aren't desirable.
- The remaining topics in this lesson examine helpful alternatives for initializing fields.

Topics

- Default Values
- Using Methods to Set Fields
- Constructors
- The `this` Keyword



Setting `Prisoner` Fields

- Currently, we need a line of code to set each field.
- Four lines are required for each `Prisoner` object.

```
public class PrisonTest {
    public static void main(String[] args){
        Prisoner p01 = new Prisoner();
        Prisoner p02 = new Prisoner();

        p01.name = "Bubba";
        p01.height = 2.08;
        p01.sentence = 4;

        p02.name = "Twitch";
        p02.height = 1.73;
        p02.sentence = 3;
    }
}
```

Methods Make Code More Efficient

- If you find yourself repeating similar lines of code …
  - Programming can become tedious.
  - It may be possible to do the same work in fewer lines.
  - Try to write that code as part of a method instead.

```
p01.name = "Bubba";
p01.height = 2.08;
p01.sentence = 4;

p02.name = "Twitch";
p02.height = 1.73;
p02.sentence = 3;
```

First occurrence

Repeated

Exercise 2

- Continue editing with the `PrisonTest` project.
- Can fields be set more efficiently?
  - Add a `setFields()` method to the `Prisoner` class.
  - This method should take three arguments, which are used to set the values for every field.
  - Replace code in the main method with calls to this method.

```
Variable:   p01
Name:       Bubba
Height:     6'10"   (2.08m)
Sentence:   4 years
```

```
Variable:   p02
Name:       Twitch
Height:     5'8"    (1.73m)
Sentence:   3 years
```

Writing a Method to Set Fields

Your solution may have looked something like this:

```
public class Prisoner {
    public String name;
    public double height;
    public int sentence;

    public void setFields(String n, double h, int s){
        name = n;
        height = h;
        sentence = s;
    }
}
```

Setting `Prisoner` Fields

- Two lines are required for each `Prisoner` object.
- But it's possible to do the same work in even fewer lines!

```
public class PrisonTest {
    public static void main(String[] args){
        Prisoner p01 = new Prisoner();
        Prisoner p02 = new Prisoner();

        p01.setFields("Bubba", 2.08, 4);
        p02.setFields("Twitch", 1.73, 3);
    }
}
```

Topics

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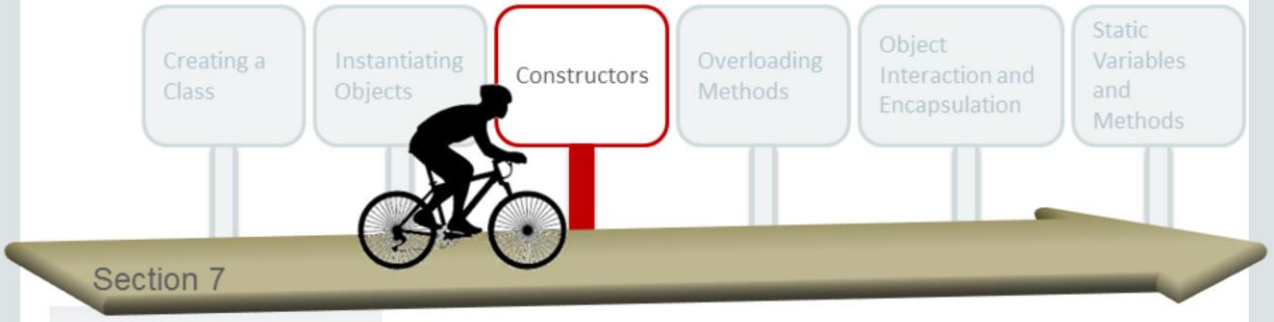
- Constructors
- The `this` Keyword



Calling a Constructor

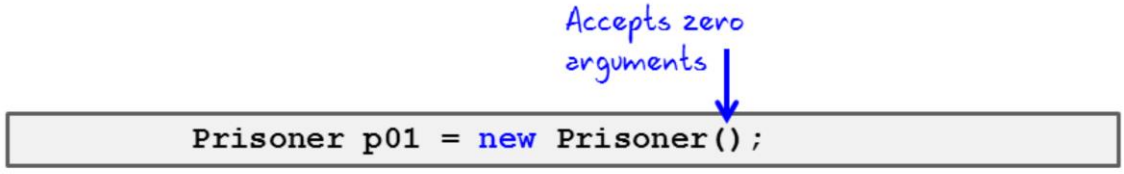
- A **constructor** is a special method.
- Its goal is to "construct" an object by setting the initial field values.
- An object's constructor is called once.
  - This occurs during instantiation.
  - And is never called again.
- We've been calling constructors this whole time.

Constructor method call

```
Prisoner p01 = new Prisoner();
```

The Default Constructor

- Java automatically provides a constructor for every class.
- It's never explicitly written in a class.
- This is called the **default constructor.**
- It's considered a **zero-argument constructor.**



Writing a Constructor Method

- You can replace the default constructor with a constructor that you wrote yourself.
- Constructors are written like any other method, except:
  - They have no return type (not even `void`).
  - They're named the same as the class.

```
//Constructor
public Prisoner(){
      System.out.println("This is a constructor");
}
```

Exercise 3, Part 1

- Continue editing with the `PrisonTest` project.
- Copy the constructor into the `Prisoner` class.
  - Run the program.
  - Observe how the code in this method is executed when `Prisoner` objects are instantiated.

```
//Constructor
public Prisoner(){
      System.out.println("This is a constructor");
}
```

Exercise 3, Part 2

- How could you modify this constructor so that it sets every field in the class?
  - Use your understanding of methods to find a solution. Remember, constructors are methods.
  - Remove the `setFields()` method. Your solution should make this method redundant.
- NetBeans will complain in the main method:
  - How could these issues be fixed?
  - Run the program after you have a solution.

You May Have Noticed …

- Constructors can be written so that they accept arguments that set initial field values.
- When you write your own constructor, the default constructor is no longer available.
- Code becomes more useful and requires fewer lines.
  - The next few slides illustrate this increased efficiency.

```
//Constructor
public Prisoner(String n, double h, int s){
    name = n;
    height = h;
    sentence = s;
}
```

Setting Fields Without a Constructor

4 lines are required for each `Prisoner` object.

```
public class PrisonTest {
    public static void main(String[] args){
        Prisoner p01 = new Prisoner();
        Prisoner p02 = new Prisoner();

        p01.name = "Bubba";
        p01.height = 2.08;
        p01.sentence = 4;

        p02.name = "Twitch";
        p02.height = 1.73;
        p02.sentence = 3;
    }
}
```

Setting Fields with a Method

2 lines are required for each `Prisoner` object.

```
public class PrisonTest {
    public static void main(String[] args){
        Prisoner p01 = new Prisoner();
        Prisoner p02 = new Prisoner();

        p01.setFields("Bubba", 2.08, 4);
        p02.setFields("Twitch", 1.73, 3);
    }
}
```

Setting Fields with a Constructor

1 line is required for each `Prisoner` object.

```
public class PrisonTest {
    public static void main(String[] args){
        Prisoner p01 = new Prisoner("Bubba", 2.08, 4);
        Prisoner p02 = new Prisoner("Twitch", 1.73, 3);
    }
}
```

Topics

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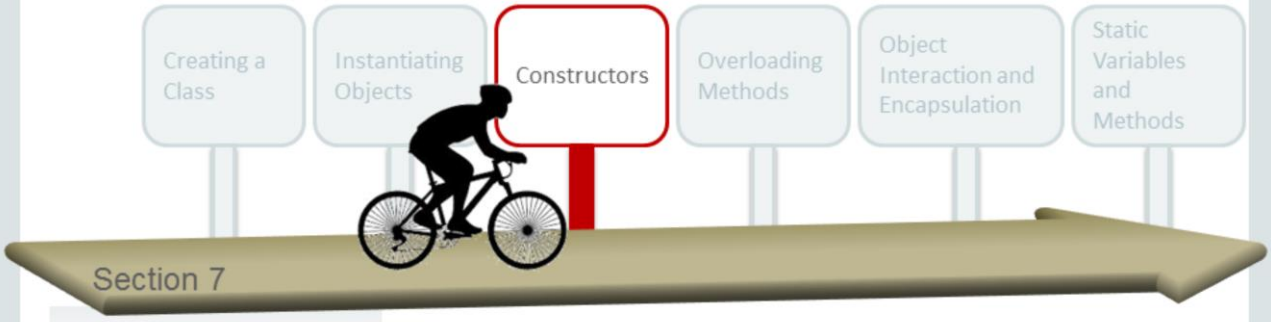

Naming Parameters

- Single-character variable names are commonly used …
  - If the variable has a very limited scope
  - If there aren't a lot of variables to keep track of
  - For testing purposes
- But earlier in this course, we encouraged giving variables a descriptive names.
  - This helps avoid confusion.
  - Definitely follow this convention for fields.
  - Some developers like to apply this convention to method parameters.

Naming Parameters the Same as Fields

- This is also a common practice, especially with constructors.
  - It's clearer what your parameters refer to.
  - But this creates scope complications.
- In the following code, is the `name` **field** or **parameter** printed?

```
public class Prisoner {
    public String name;

    public setName(String name){
        System.out.println(name);
    }
}
```

Which Version of `name` Is Printed?

- The **parameter** is printed.
  - Variables within the most local scope take priority.
  - In other words, the variables within the most recent scope.
- Can the **field** still be accessed?
  - Yes! Fields exist within the scope of their class methods.
  - But more syntax is required to access to them.

```
public class Prisoner {
    public String name;

    public setName(String name){
        System.out.println(name);
    }
}
```

The `this` Keyword

- `this` is a reference to the current object.
  - You can treat it like any other object reference.
  - Which means you can use the dot operator (`.`).
- `this.name` accesses the Prisoner's field.
- `this.setName()` accesses the Prisoner's method.

```
public class Prisoner {
    public String name;

    public setName(String name){
        this.name = name;
    }
}
```

Exercise 4

- Modify the `Prisoner` constructor.
  - Change the parameters of this method so that each parameter's name matches the name of a field.
  - Set each field's value by using the `this` keyword.

Summary of Constructors

- Are special methods in a class
- Named the same as the class
- Have no return type (not even void)
- Called only once during object instantiation
- May accept arguments
- Used to set initial values of fields
- If you don't write your own constructor, Java provides a default zero-argument constructor

Summary

In this lesson, you should have learned how to:

- Understand default values
- Crash the program with a `null` reference
- Understand the default constructor
- Write a constructor that accepts arguments
- Initialize fields with a constructor
- Use `this` as an object reference


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