6

Describing Objects and Classes

ORACLE

Interactive Quizzes

Objectives

After completing this lesson, you should be able to:

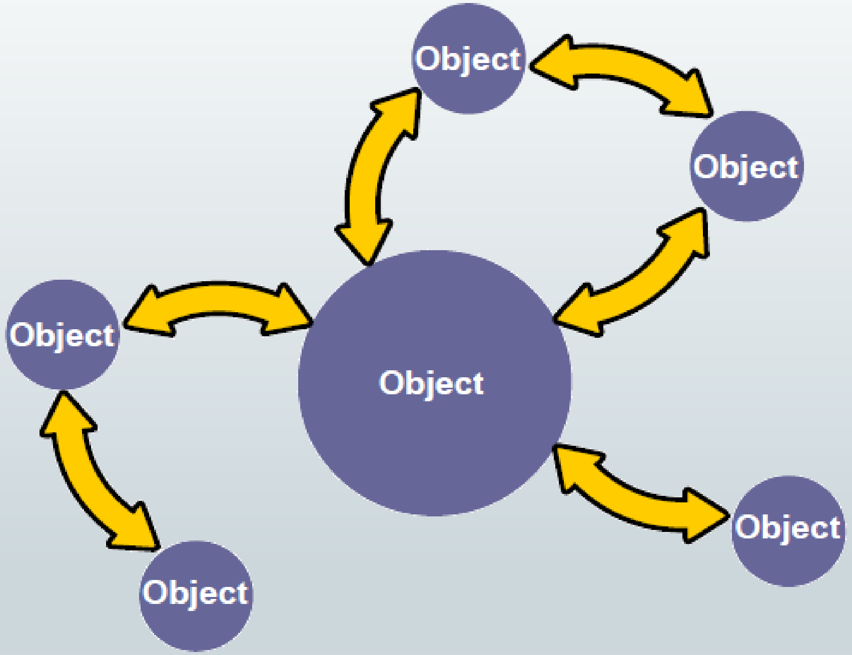
- List the characteristics of an object
- Define an object as an instance of a class
- Instantiate an object and access its fields and methods
- Describe how objects are stored in memory
- Instantiate an array of objects
- Describe how an array of objects is stored in memory
- Declare and instantiate an object as a field

Topics

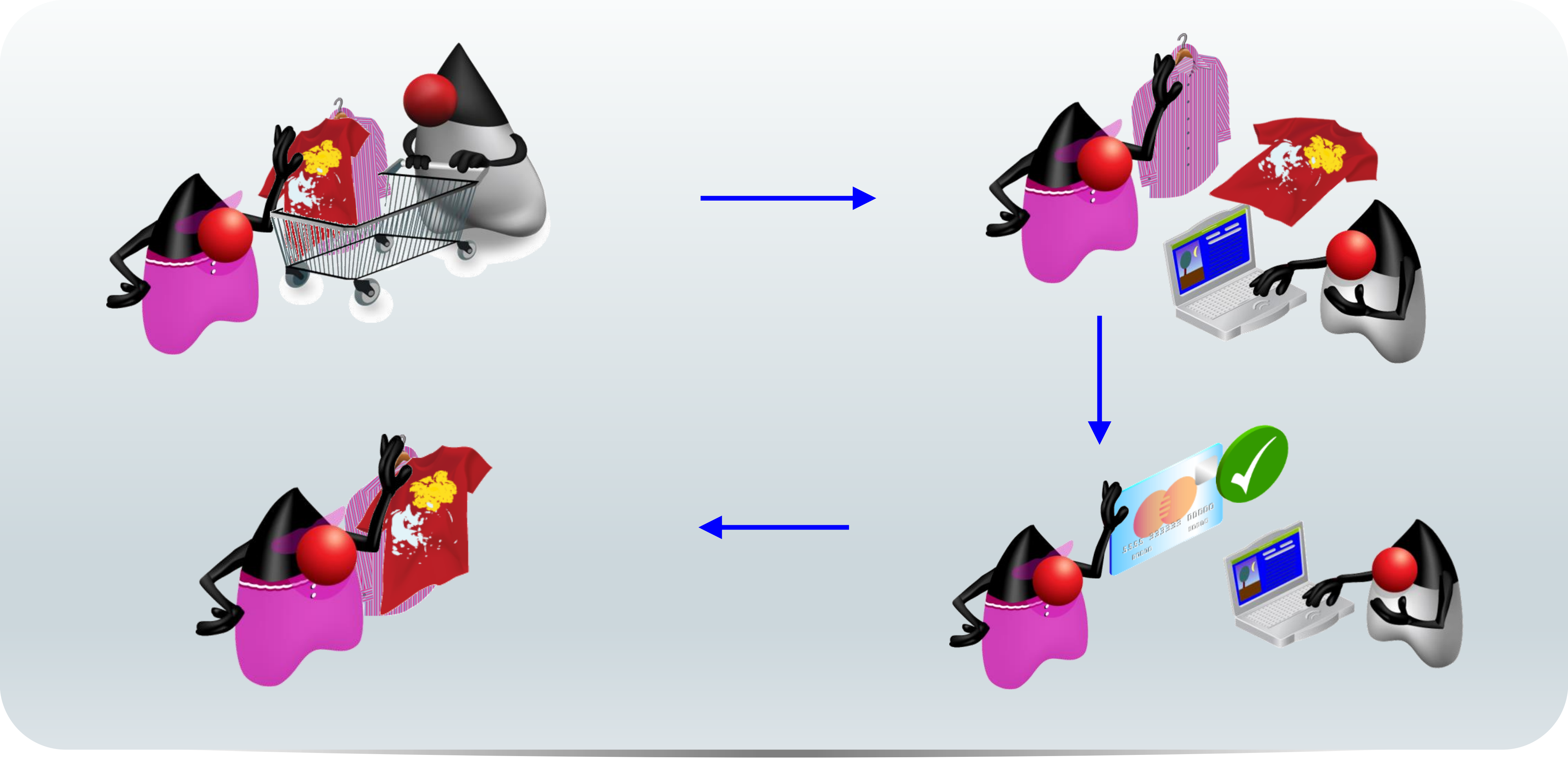
- Describing objects and classes
- Defining fields and methods
- Declaring, instantiating, and using objects
- Working with object references
- Doing more with arrays
- Introducing the soccer league use case

Object-Oriented Programming

- Interaction of objects
- No prescribed sequence



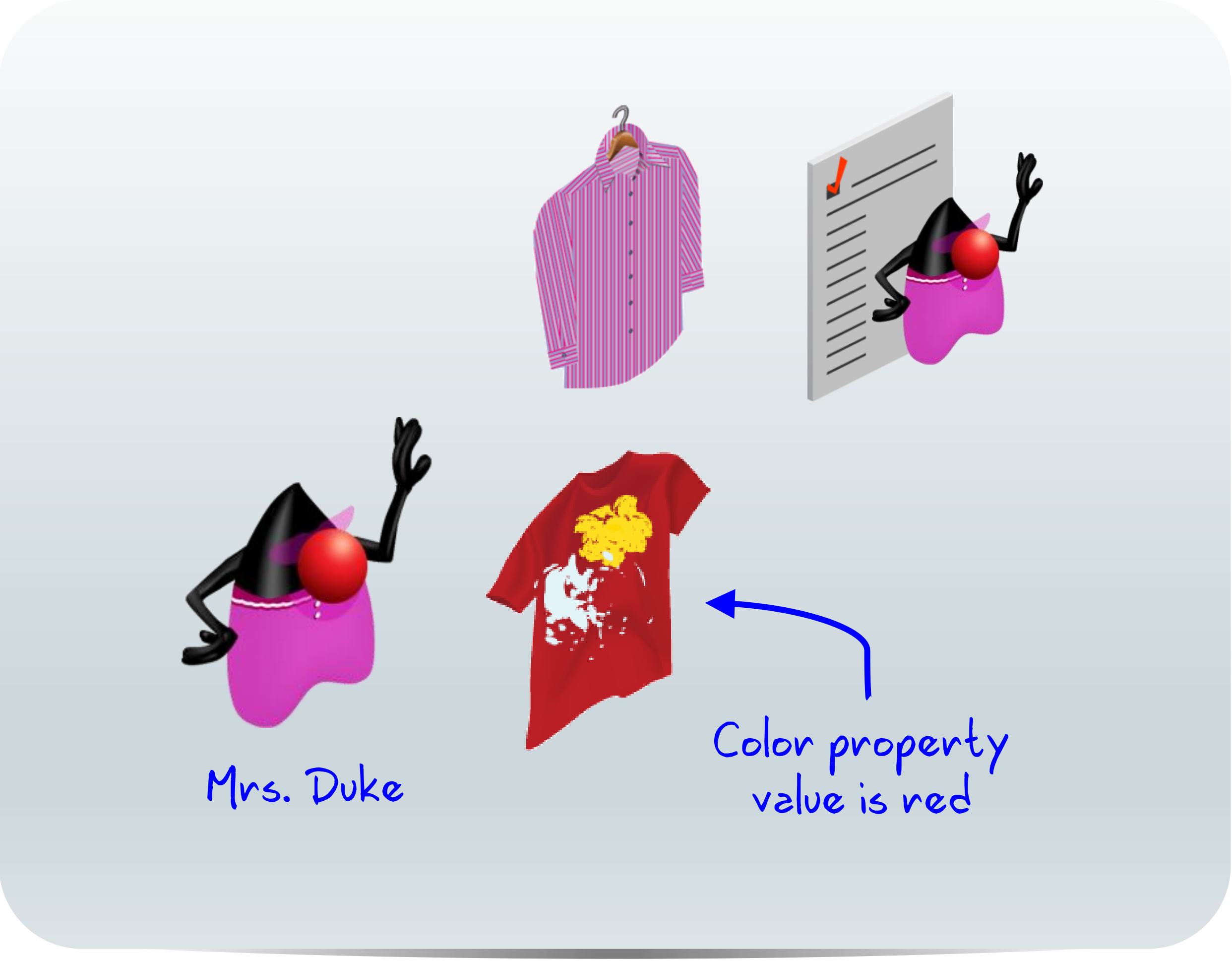
Duke's Choice Order Process



Characteristics of Objects

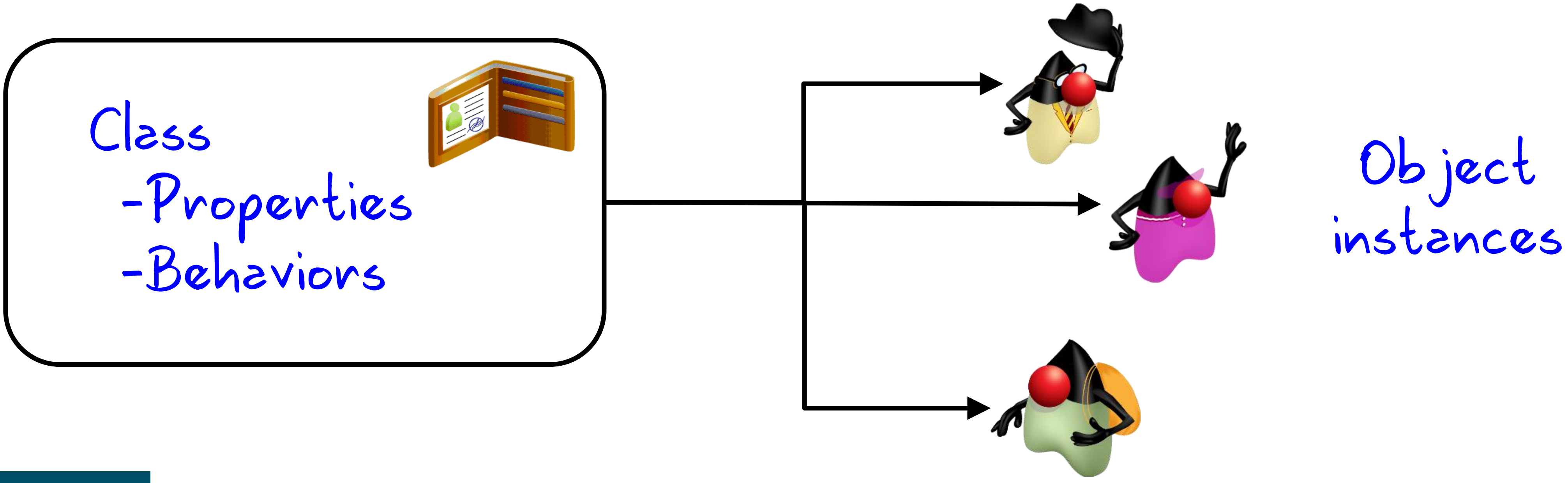
Objects are physical or conceptual.

- Objects have **properties**:
  - Size
  - Shape
  - Name
  - Color
- Objects have **behaviors**:
  - Shop
  - Put item in cart
  - Pay



Classes and Instances

- A class:
  - Is a blueprint or recipe for an object
  - Describes an object's properties and behaviors
  - Is used to create object instances



Quiz

Which of the following statements is true?

a. An object is a blueprint for a class.

b. An object and a class are exactly the same.

c. An object is an instance of a class.

d. A class is an instance of an object.

Topics

- Describing objects and classes
- Defining fields and methods
- Declaring, instantiating, and using objects
- Working with object references
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The Customer Properties and Behaviors

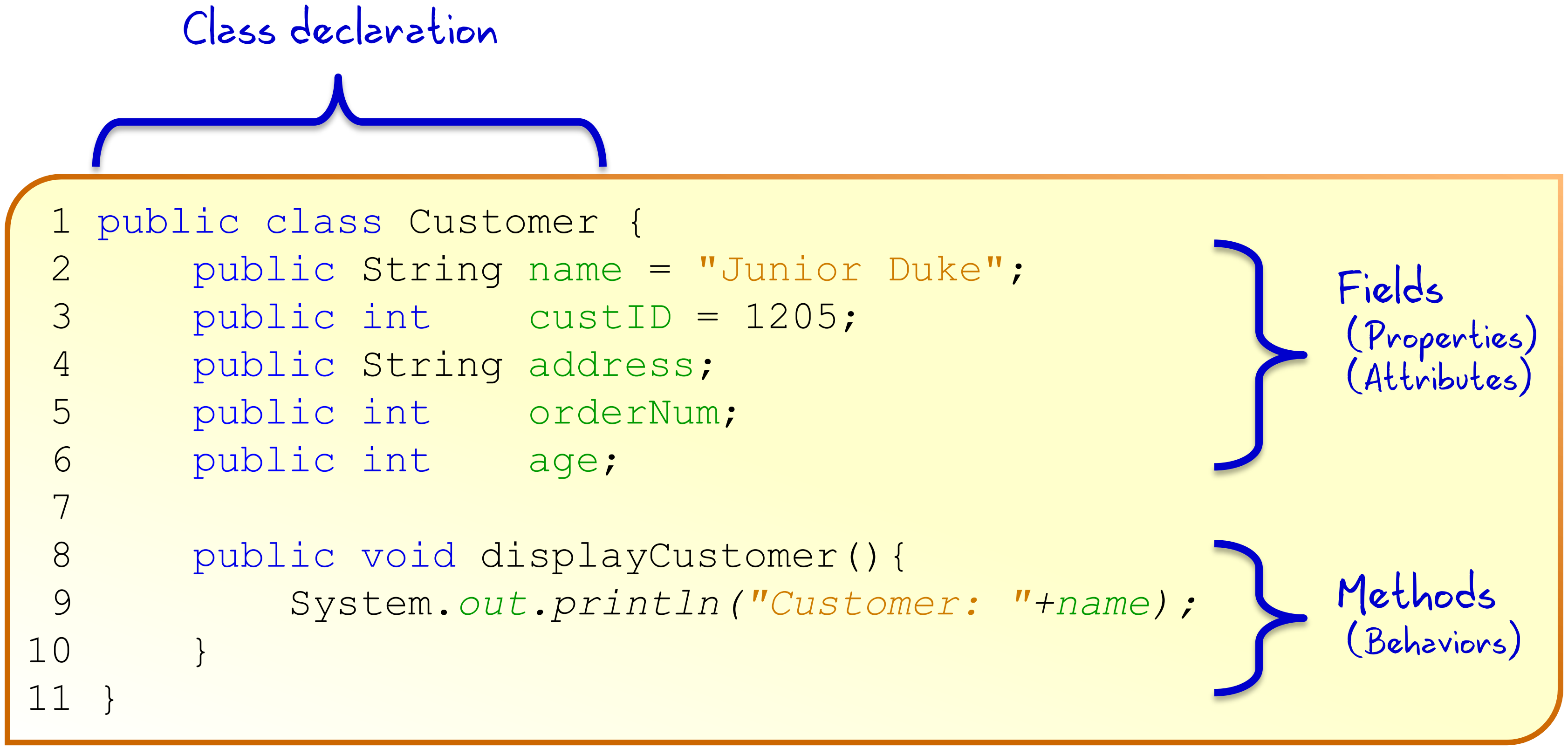
Properties:

- Name
- Address
- Age
- Order number
- Customer number

Behaviors:

- Shop
- Set Address
- Add item to cart
- Ask for a discount
- Display customer details

The Components of a Class



Class declaration

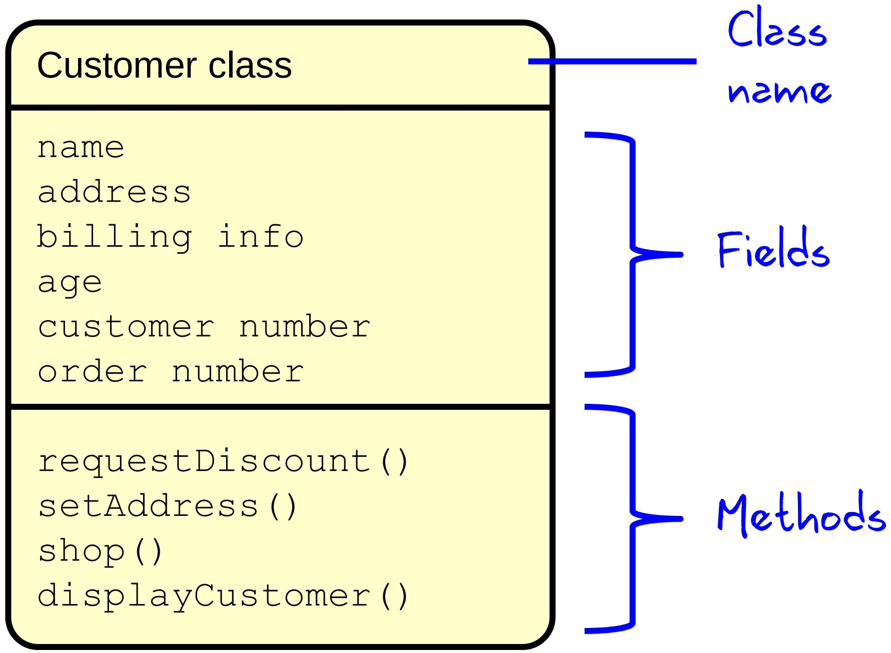
```
public class Customer {
    public String name = "Junior Duke";
    public int    custID = 1205;
    public String address;
    public int    orderNum;
    public int    age;

    public void displayCustomer(){
        System.out.println("Customer: "+name);
    }
}
```

Fields
(Properties)
(Attributes)

Methods
(Behaviors)

Modeling Properties and Behaviors



Customer class

```
name
address
billing info
age
customer number
order number
```

```
requestDiscount()
setAddress()
shop()
displayCustomer()
```

Exercise 6-1: Creating the `Item` Class

1. Open the project **`Exercise_06-1`** in NetBeans
2. Create the Item class as a plain **Java class**.
3. Declare public fields for `ID` (int), `descr` (String), `price` (double), and `quantity` (int).
   - You will not be able to test the `Item` class until Exercise 6-2.

Topics

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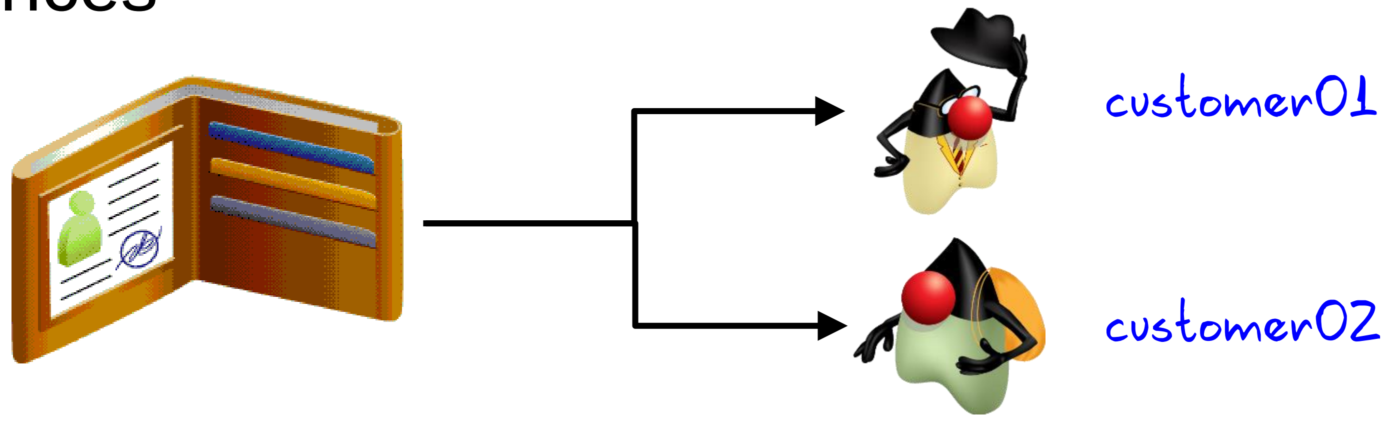
Customer Instances



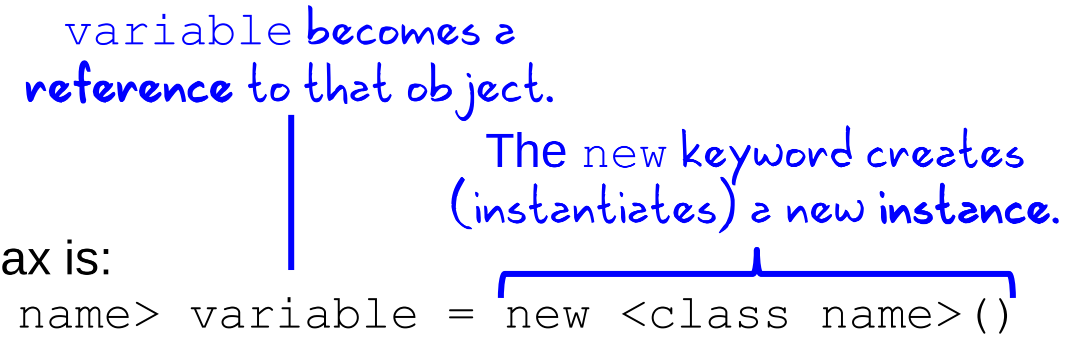
```
public static void main(String[] args){

   Customer customer01 = new Customer();
   Customer customer02 = new Customer();

   customer01.age = 40;
   customer02.name = "Duke";

   customer01.displayCustomer();
   customer02.displayCustomer();
   }
}
```

Create new instances (instantiate).

Fields are accessed.

Methods are called.

Object Instances and Instantiation Syntax



variable becomes a reference to that object.

The new keyword creates (instantiates) a new instance.

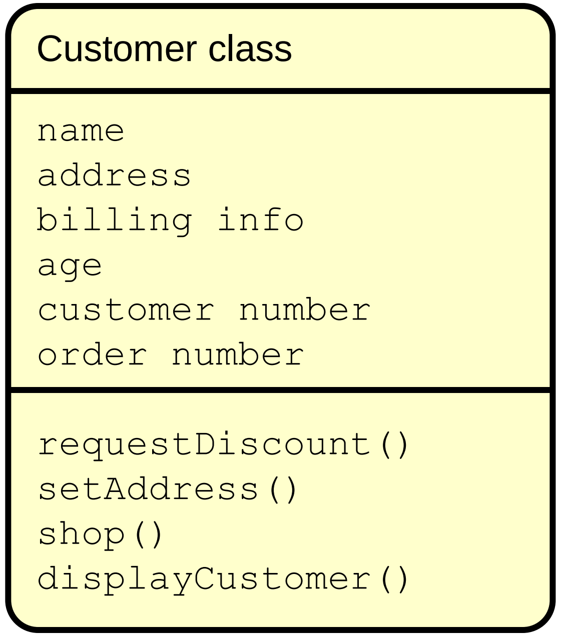
The syntax is:

```
<class name> variable = new <class name>()
```

```
public static void main(String[] args){

   Customer customer01 = new Customer();   //Declare and instantiate

   Customer customer02;                    //Declare the reference
   customer02 = new Customer();            //Then instantiate

   new Customer();                 //Instantiation without a reference
                                   //We can’t use this object later
                                   //without knowing how to reference it.

   }
}
```

The Dot (.) Operator

Follow the reference variable with a dot operator (.) to access the fields and methods of an object.



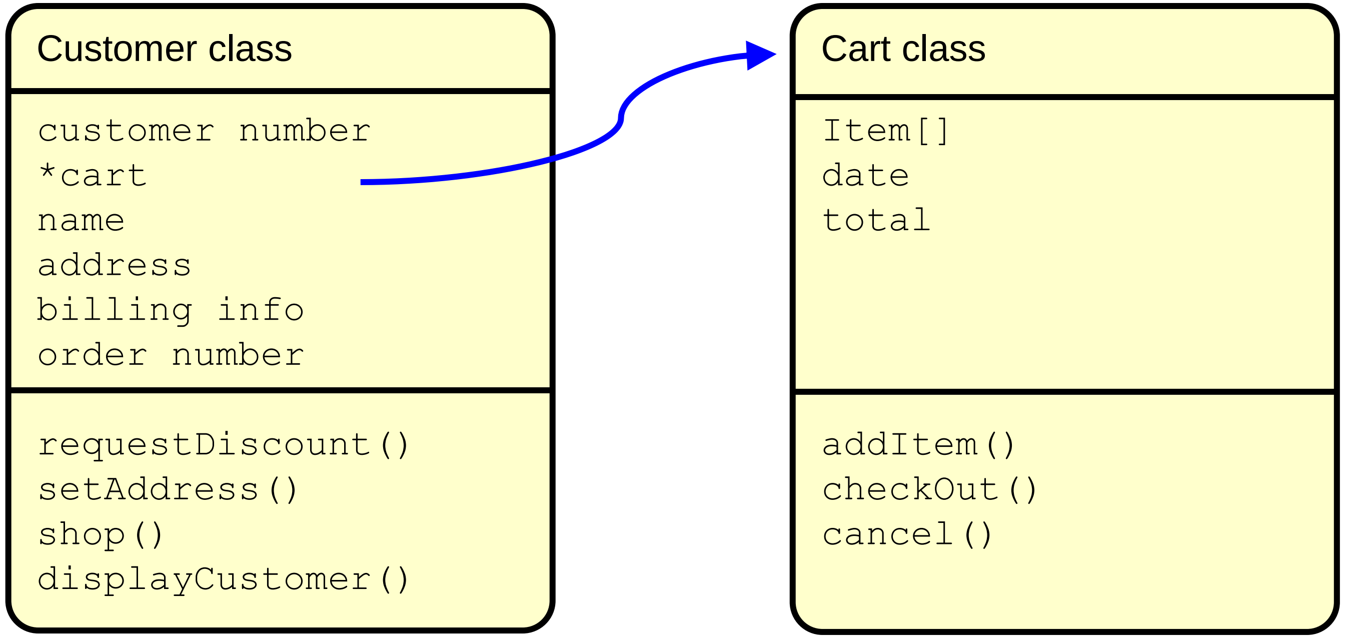
Customer class

name
address
billing info
age
customer number
order number

requestDiscount()
setAddress()
shop()
displayCustomer()

```
public static void main(String[] args){

    Customer customer01 = new Customer();

    //Accessing fields
    System.out.println(customer01.name);
    customer01.age = 40;

    //Calling methods
    customer01.requestDiscount();
    customer01.displayCustomer();
    }
}
```

Objects with Another Object as a Property



Customer class

customer number
*cart
name
address
billing info
order number

requestDiscount()
setAddress()
shop()
displayCustomer()

Cart class

Item[]
date
total

addItem()
checkOut()
cancel()

```
public static void main(String[] args){

    Customer customer01 = new Customer();
    customer01.cart.cancel();              //How to access methods of an
                                           //object within another object
}
```

Quiz

Which of the following lines of code instantiates a `Boat` object and assigns it to a `sailBoat` object reference?

a. `Boat sailBoat = new Boat();`

b. `Boat sailBoat;`

c. `Boat = new Boat()`

d. `Boat sailBoat = Boat();`

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Topics

- Describing objects and classes
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- Working with object references
- Doing more with arrays
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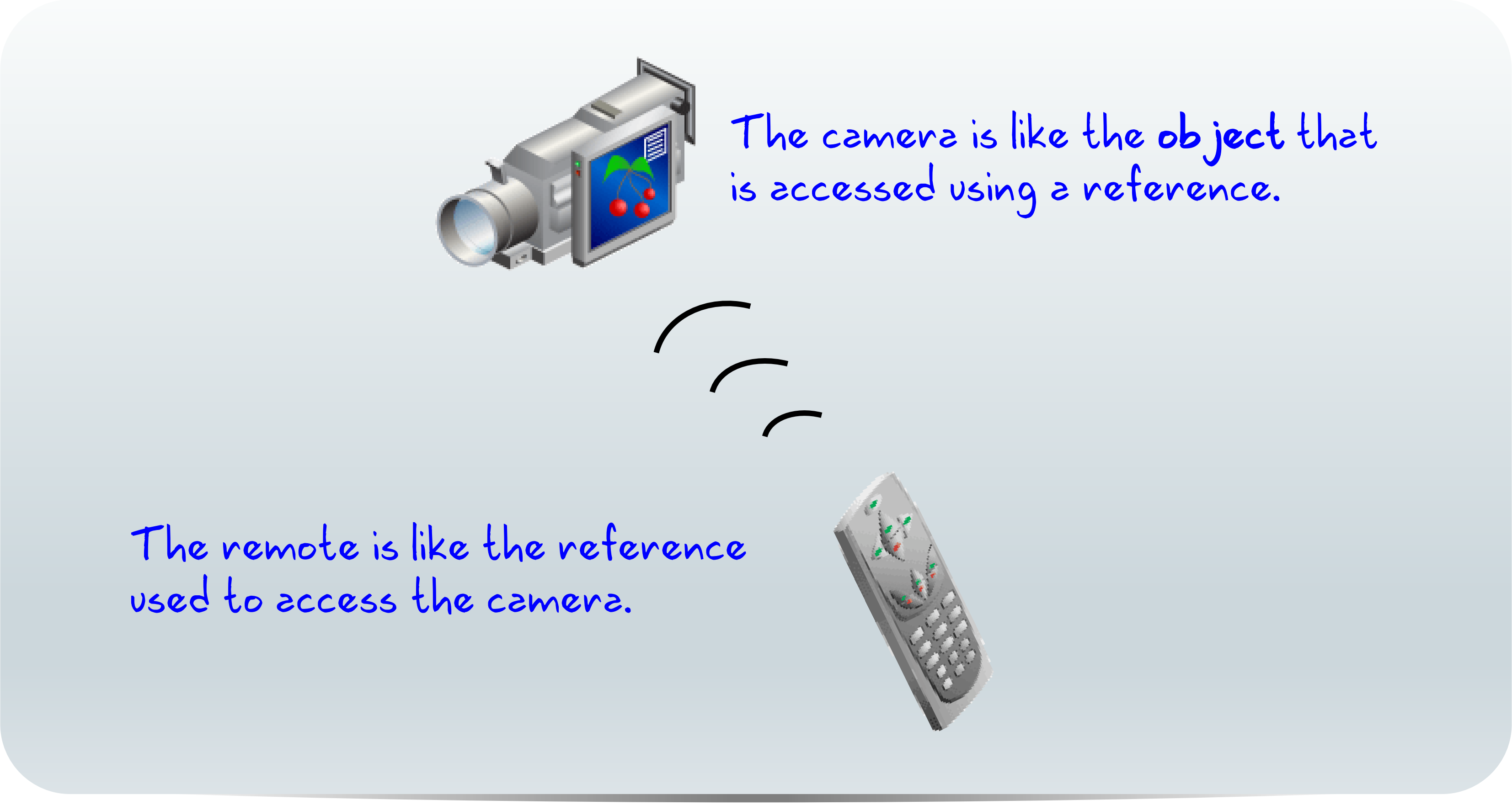
Accessing Objects by Using a Reference

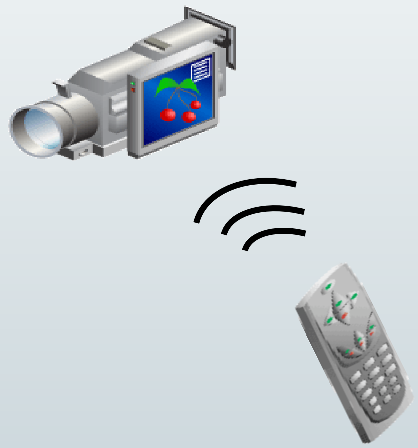


The camera is like the **object** that is accessed using a reference.

The remote is like the reference used to access the camera.

Working with Object References

1 Pick up the remote to gain access to the camera.



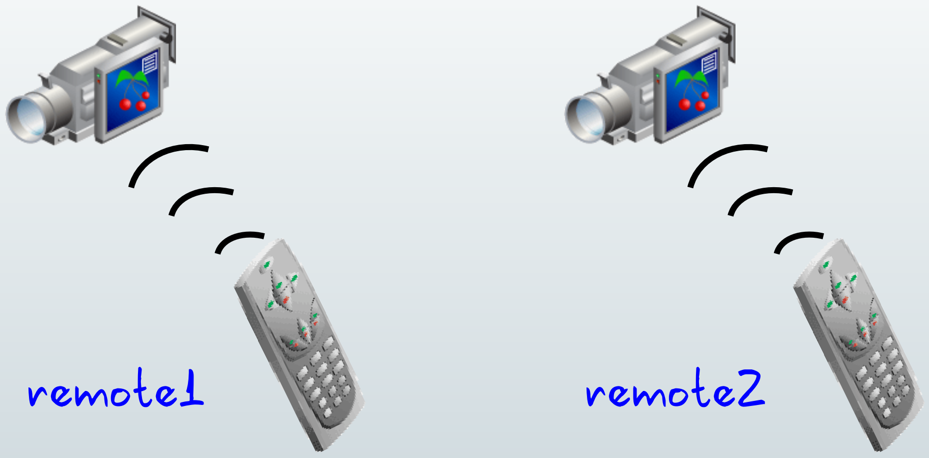
2 Press the remote's controls to have camera do something.

1 Create a Camera object and get a reference to it.

```
Camera remote1;

remote1 =  new Camera();

remove1.play();
```

2 Call a method to have the Camera object do something.

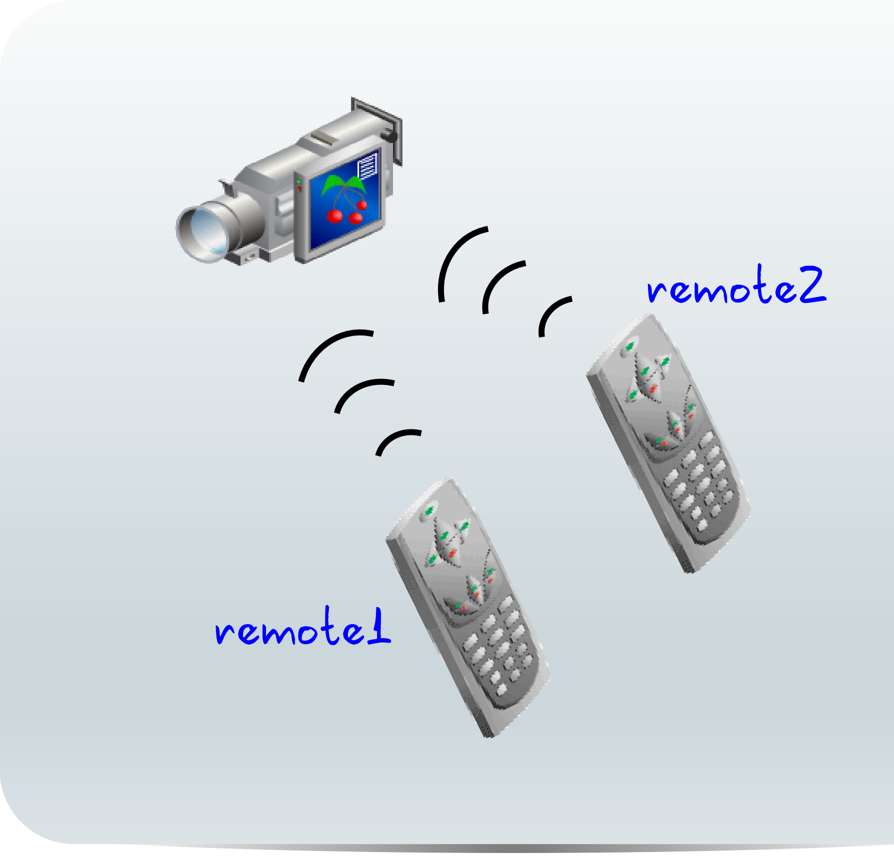
Working with Object References



```
Camera remote1 = new Camera();

Camera remote2 = new Camera();

remote1.play();

remote2.play();
```

There are two Camera objects.

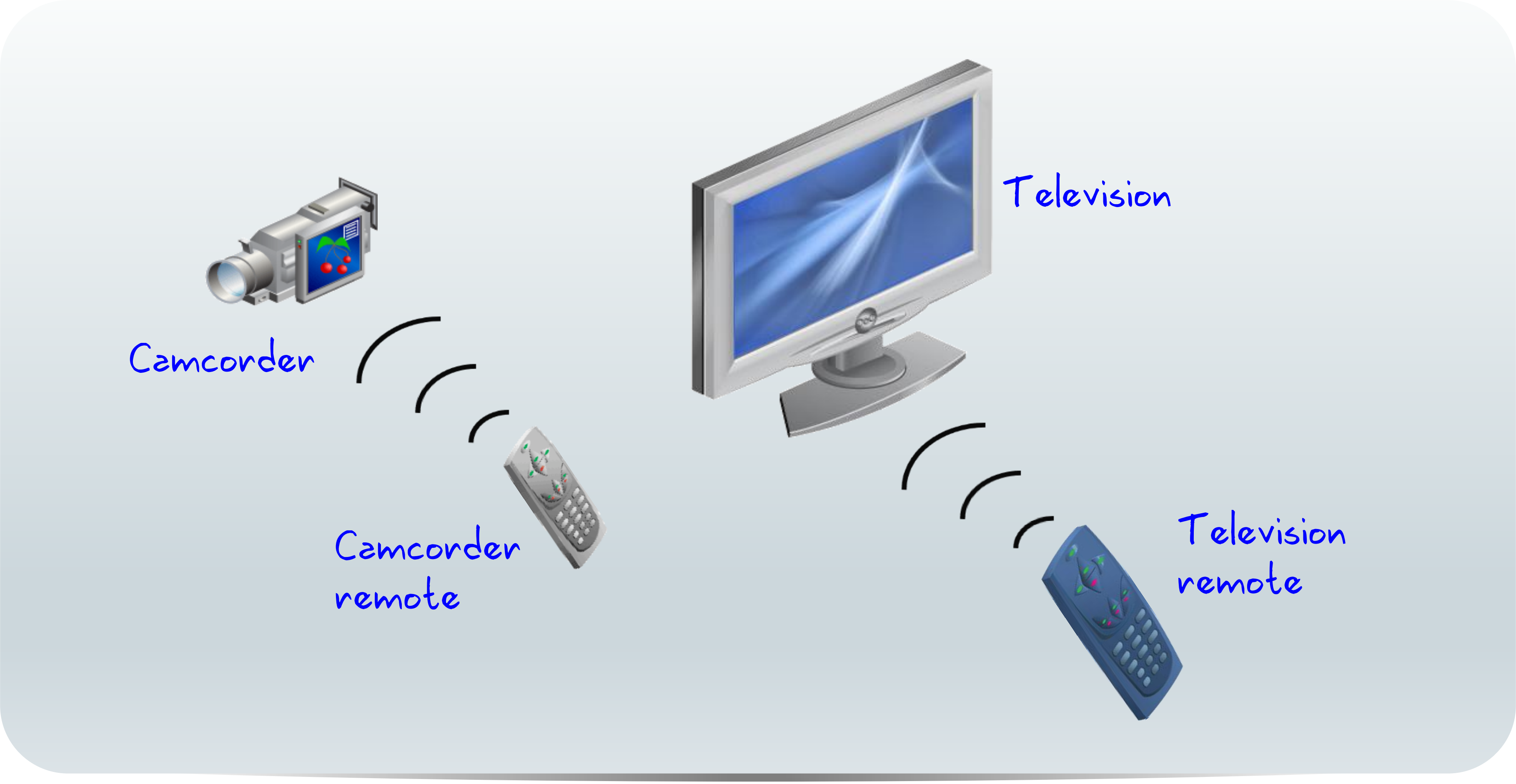
Working with Object References



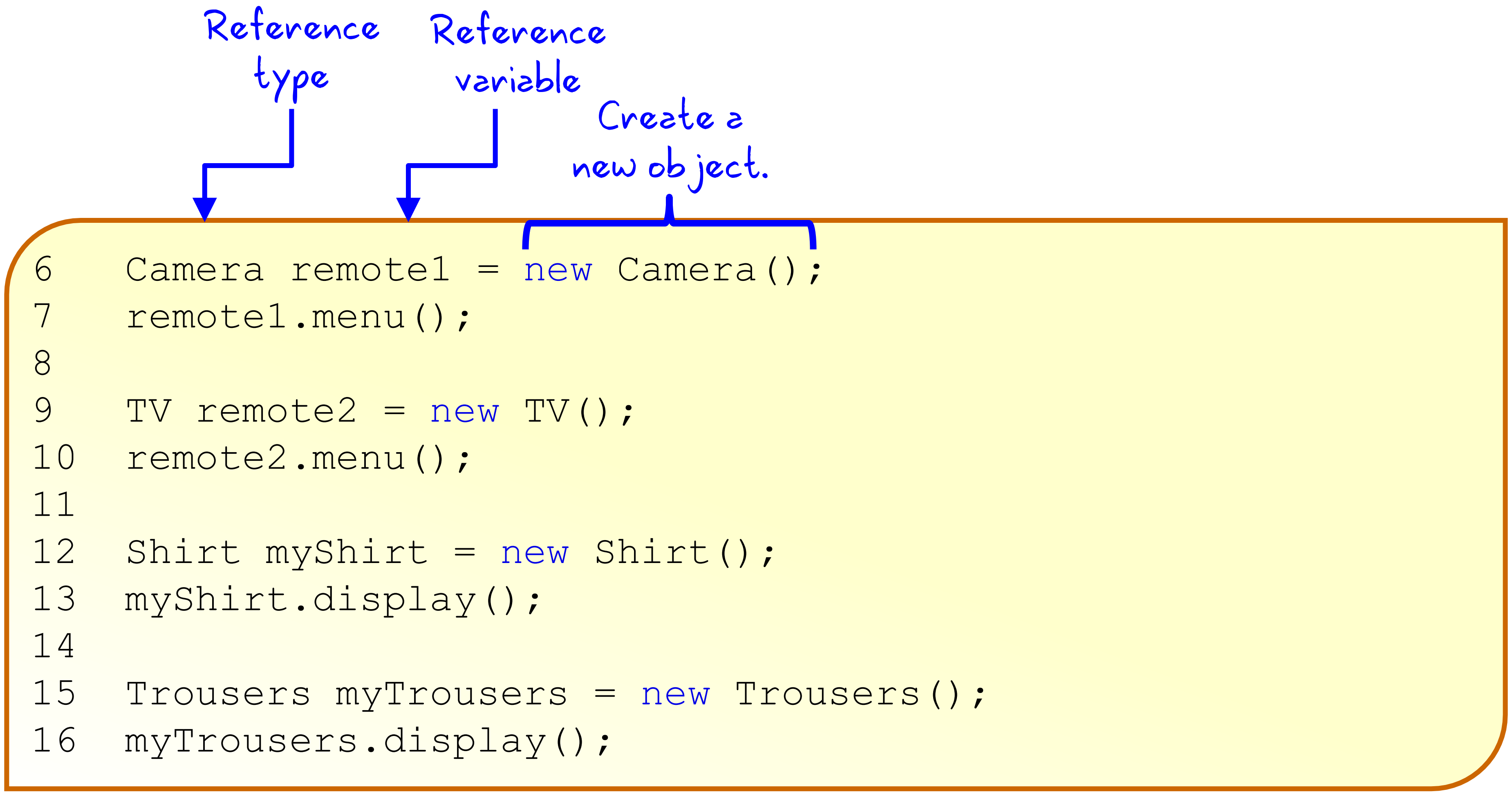
There is only one Camera object.

```
Camera remote1 = new Camera();

Camera remote2 = remote1;

remote1.play();

remote2.stop();
```

References to Different Objects



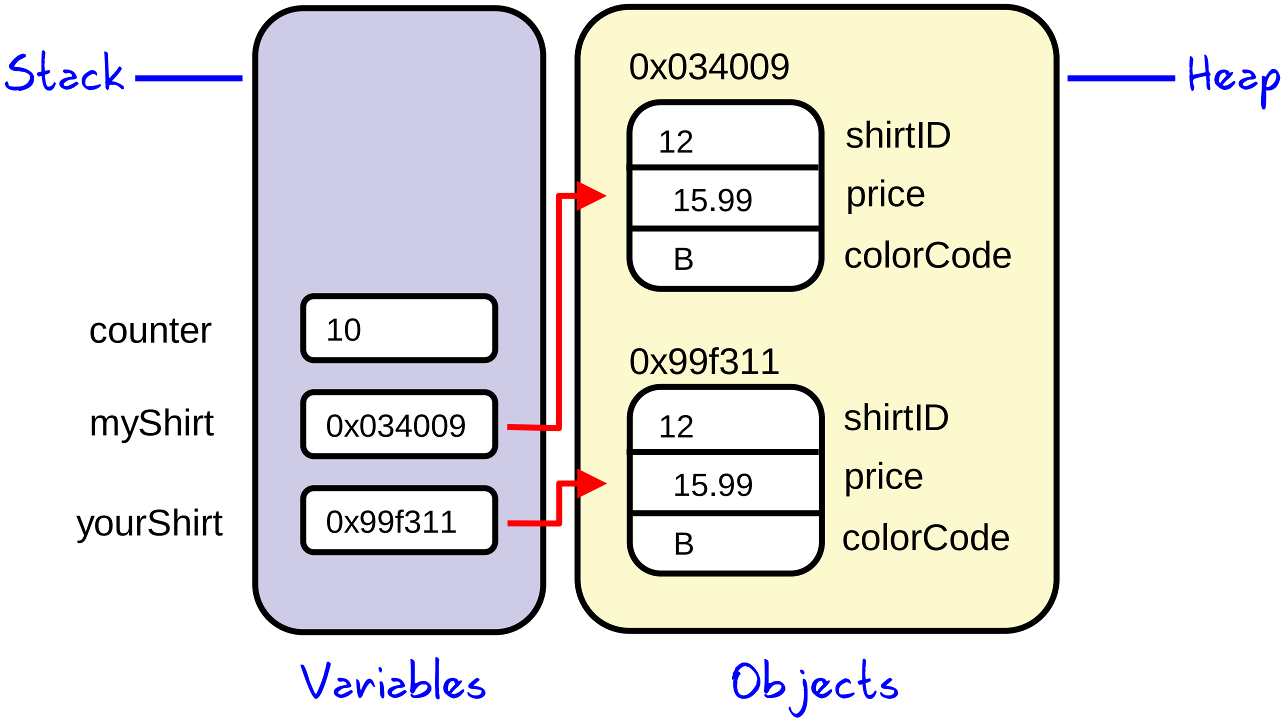
References to Different Objects



```java
Camera remote1 = new Camera();
remote1.menu();

TV remote2 = new TV();
remote2.menu();

Shirt myShirt = new Shirt();
myShirt.display();

Trousers myTrousers = new Trousers();
myTrousers.display();
```

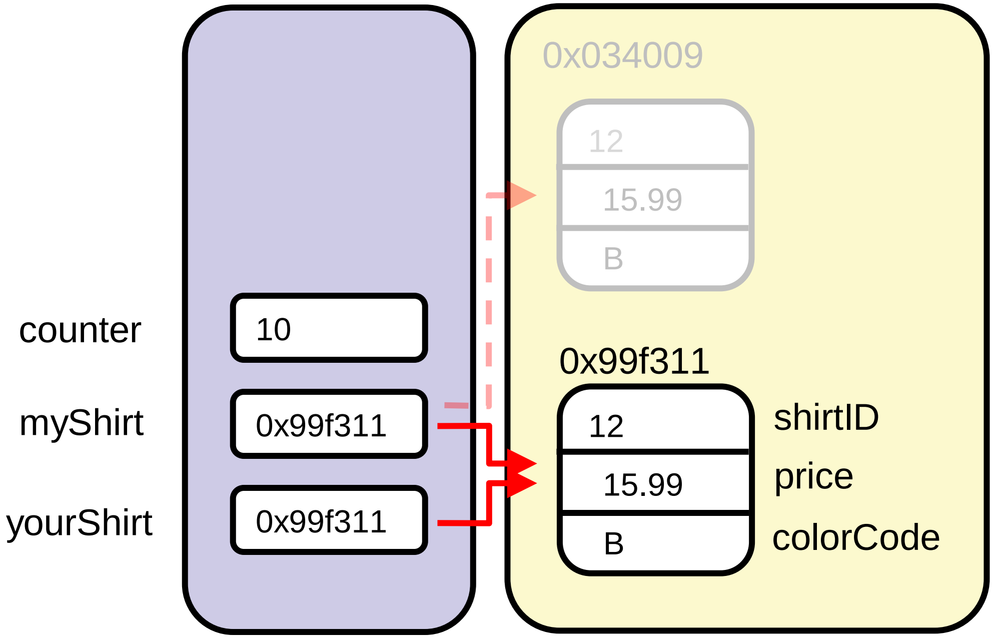
References and Objects in Memory

```java
int counter = 10;
Shirt myShirt = new Shirt();
Shirt yourShirt = new Shirt();
```



Assigning a Reference to Another Reference

```
myShirt = yourShirt;
```



Two References, One Object

Code fragment:

```
Shirt myShirt = new Shirt();
Shirt yourShirt = new Shirt();

myShirt = yourShirt;    //The old myShirt object is
                        //no longer referenced
myShirt.colorCode = 'R';
yourShirt.colorCode = 'G';

System.out.println("Shirt color: ” + myShirt.colorCode);
```

Output from code fragment:

```
Shirt color: G
```

Exercise 6-2: Modifying the ShoppingCart to Use Item Fields

1. Continue editing **Exercise_06-1** or open **Exercise_06-2** in NetBeans.
2. Create a new Java Main Class called ShoppingCart. This class contains a single main method. The rest of this exercise is spent modifying ShoppingCart.java.
3. Declare and instantiate two objects of type Item. Initialize only the descry field in each, using different values for each.
4. Print the description for each item and run the code.
5. (Optional) Above the code that prints the descriptions, assign item2 to item1. Run it again.

Topics

- Describing objects and classes
- Defining fields and methods
- Declaring, instantiating, and using objects
- Working with object references
- Doing more with arrays
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Arrays Are Objects

Arrays are handled by an implicit Array *object*.

- The Array variable is an *object reference*, not a primitive data type.
- It must be instantiated, just like other objects.
  - Example:

```
int[] ages = new int[4];
```

This array can hold four elements.

- Previously, you have been using a shortcut to instantiate your arrays.
  - Example:

```
int[] ages = {8,7,4,5};
```

Declaring, Instantiating, and Initializing Arrays

- Examples:

```
String[] names = {"Mary","Bob","Carlos"};

int[] ages = new int[3];
ages[0] = 19;
ages[1] = 42;
ages[2] = 92;
```

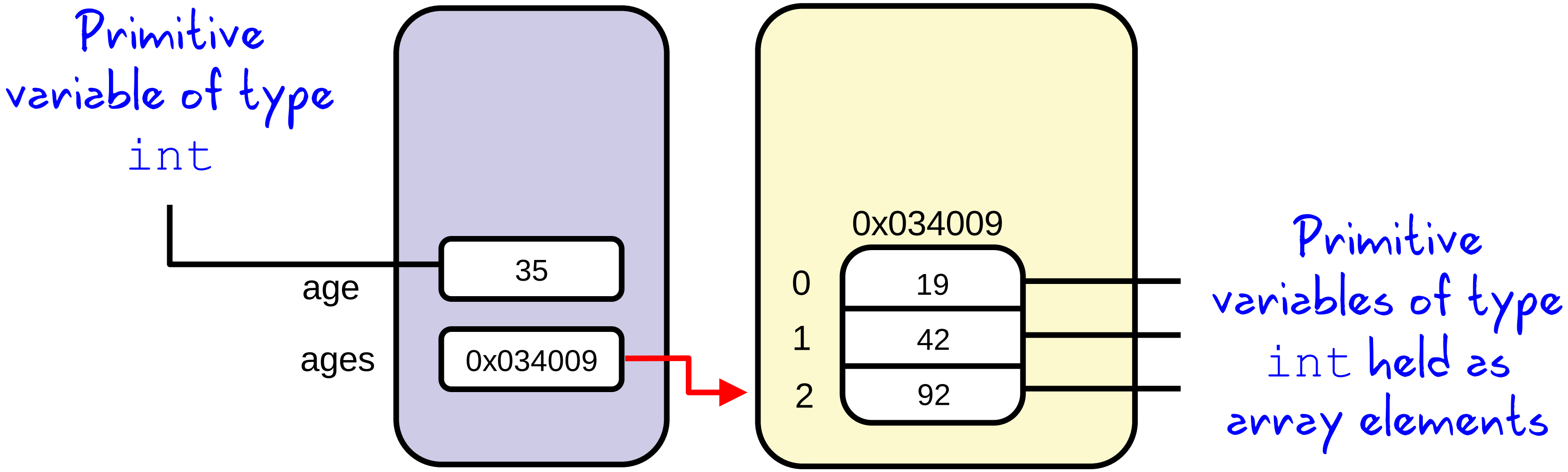
This statement declares an integer array ages and initializes the elements with default value of 0

- Not permitted (compiler will show an error):

```
int[] ages;
ages = {19, 42, 92};
```

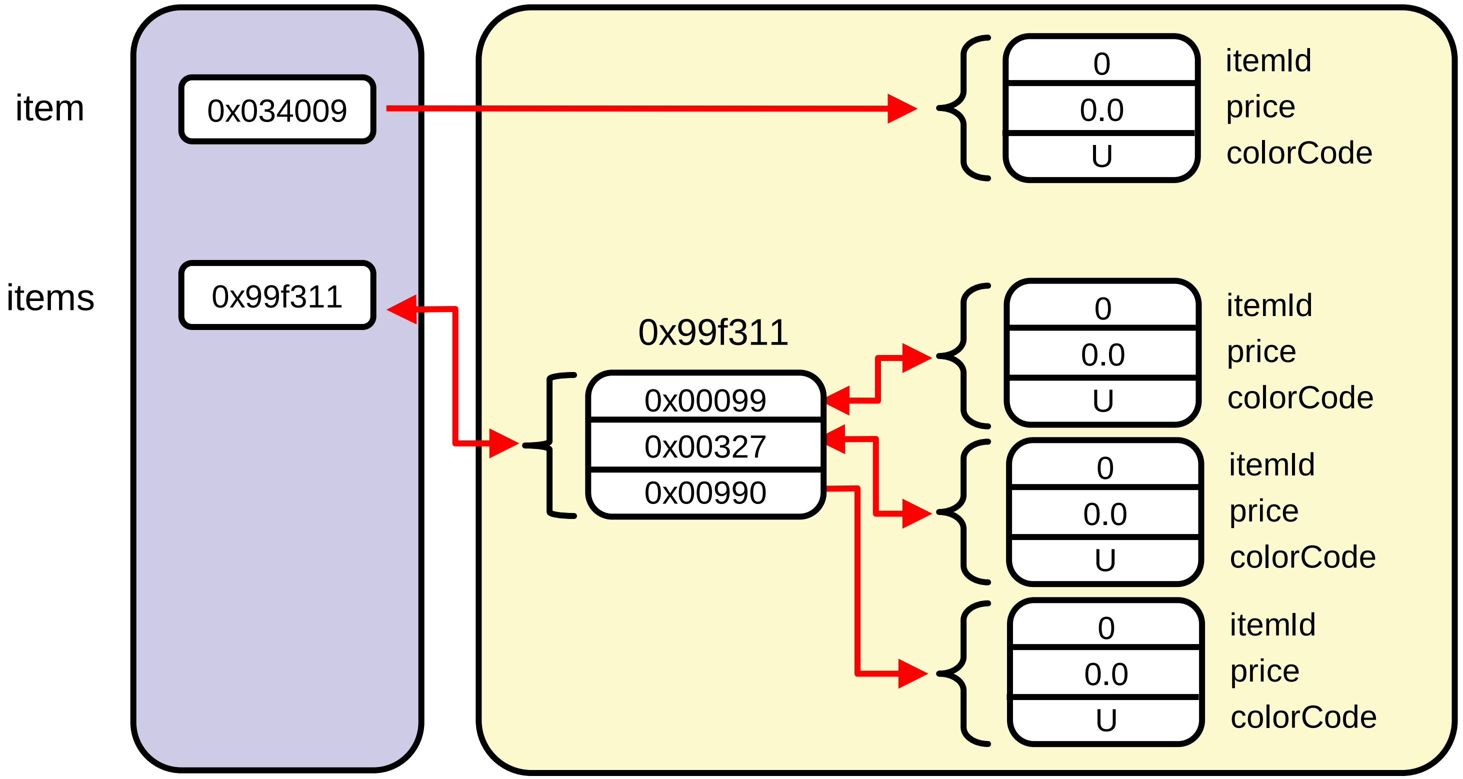
Storing Arrays in Memory

```
int age = 35;
int[] ages = {19, 42, 92};
```


Primitive variable of type int
age
35
ages
0x034009
0x034009
0
19
1
42
2
92
Primitive variables of type int held as array elements

Storing Arrays of Object References in Memory

```
Item item = new Item();
Item[] items = { new Item(), new Item(), new Item() };
```



Quiz

The following code is the correct syntax for _____ an array:

```
array_identifier = new type[length];
```

a. Declaring

b. Setting array values for

c. Instantiating

d. Declaring, instantiating, and setting array values for

Quiz

Given the following array declaration, which of the following statements are true?

```
      int[ ] ages = new int[13];
```

a. `ages[0]` is the reference to the first element in the array.

b. `ages[13]` is the reference to the last element in the array.

c. There are 13 integers in the `ages` array.

d. `ages[5]` has a value of 0.

Topics

- Describing objects and classes
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- Working with object references
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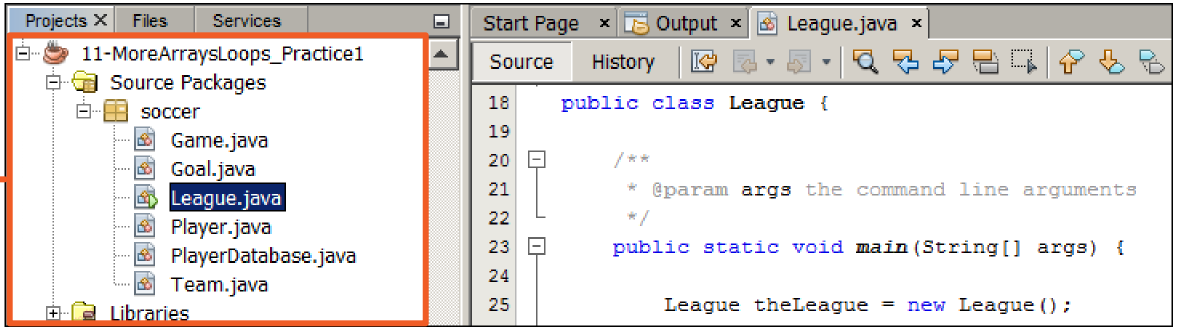
Soccer Application

Practices 6 through 14 build a soccer league application with the following features:

- Any number of soccer teams, each with up to 11 players
- Set up an all-play-all league.
- Use a random play game generator to create test games.
- Determine the rank order of teams at the end of the season.

Creating the Soccer Application

A separate project for each practice



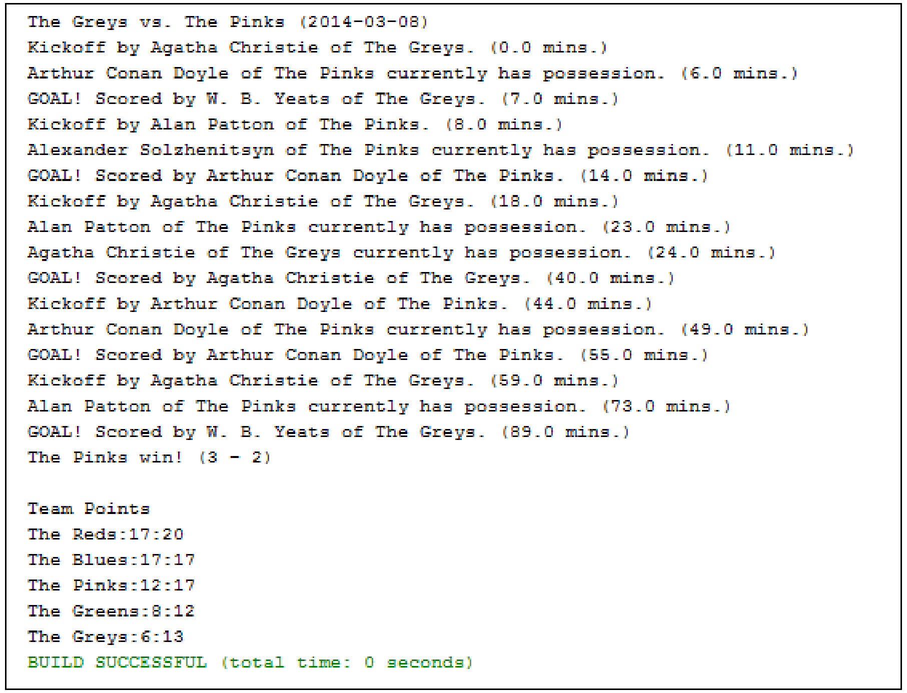
```
public class League {

    /**
     * @param args the command line arguments
     */
    public static void main(String[] args) {

        League theLeague = new League();
```

Sample output showing events in a game

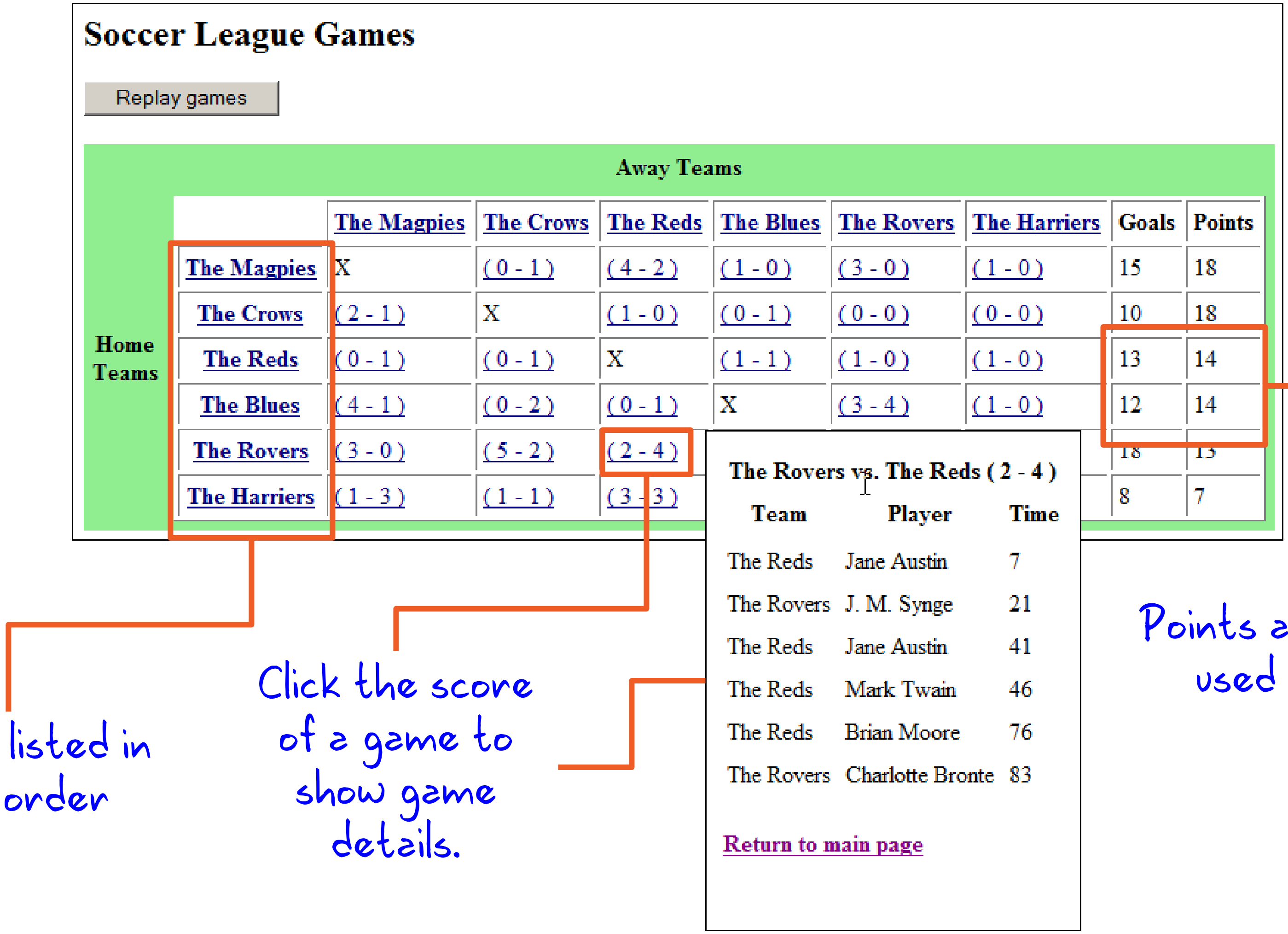
Sample output showing rank order of teams



```
The Greys vs. The Pinks (2014-03-08)
Kickoff by Agatha Christie of The Greys. (0.0 mins.)
Arthur Conan Doyle of The Pinks currently has possession. (6.0 mins.)
GOAL! Scored by W. B. Yeats of The Greys. (7.0 mins.)
Kickoff by Alan Patton of The Pinks. (8.0 mins.)
Alexander Solzhenitsyn of The Pinks currently has possession. (11.0 mins.)
GOAL! Scored by Arthur Conan Doyle of The Pinks. (14.0 mins.)
Kickoff by Agatha Christie of The Greys. (18.0 mins.)
Alan Patton of The Pinks currently has possession. (23.0 mins.)
Agatha Christie of The Greys currently has possession. (24.0 mins.)
GOAL! Scored by Agatha Christie of The Greys. (40.0 mins.)
Kickoff by Arthur Conan Doyle of The Pinks. (44.0 mins.)
Arthur Conan Doyle of The Pinks currently has possession. (49.0 mins.)
GOAL! Scored by Arthur Conan Doyle of The Pinks. (55.0 mins.)
Kickoff by Agatha Christie of The Greys. (59.0 mins.)
Alan Patton of The Pinks currently has possession. (73.0 mins.)
GOAL! Scored by W. B. Yeats of The Greys. (89.0 mins.)
The Pinks win! (3 - 2)

Team Points
The Reds:17:20
The Blues:17:17
The Pinks:12:17
The Greens:8:12
The Greys:6:13
BUILD SUCCESSFUL (total time: 0 seconds)
```

Soccer Web Application



Soccer League Games

Away Teams

Home Teams		The Magpies	The Crows	The Reds	The Blues	The Rovers	The Harriers	Goals	Points
	The Magpies	X	(0 - 1)	(4 - 2)	(1 - 0)	(3 - 0)	(1 - 0)	15	18
	The Crows	(2 - 1)	X	(1 - 0)	(0 - 1)	(0 - 0)	(0 - 0)	10	18
	The Reds	(0 - 1)	(0 - 1)	X	(1 - 1)	(1 - 0)	(1 - 0)	13	14
	The Blues	(4 - 1)	(0 - 2)	(0 - 1)	X	(3 - 4)	(1 - 0)	12	14
	The Rovers	(3 - 0)	(5 - 2)	(2 - 4)				18	13
	The Harriers	(1 - 3)	(1 - 1)	(3 - 3)				8	7

The Rovers vs. The Reds (2 - 4)

Team	Player	Time
The Reds	Jane Austin	7
The Rovers	J. M. Synge	21
The Reds	Jane Austin	41
The Reds	Mark Twain	46
The Reds	Brian Moore	76
The Rovers	Charlotte Bronte	83

Return to main page

Teams listed in rank order

Click the score of a game to show game details.

Points and goals scored used for ordering

Summary

In this lesson, you should have learned how to:

- Describe the characteristics of a class
- Define an object as an instance of a class
- Instantiate an object and access its fields and methods
- Describe how objects are stored in memory
- Instantiate an array of objects
- Describe how an array of objects is stored in memory
- Declare an object as a field

Practices Overview

- 6-1: Creating Classes for the Soccer League
- 6-2: Creating a Soccer Game