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Java Foundations

2-3

Introduction to Object-Oriented Programming Concepts

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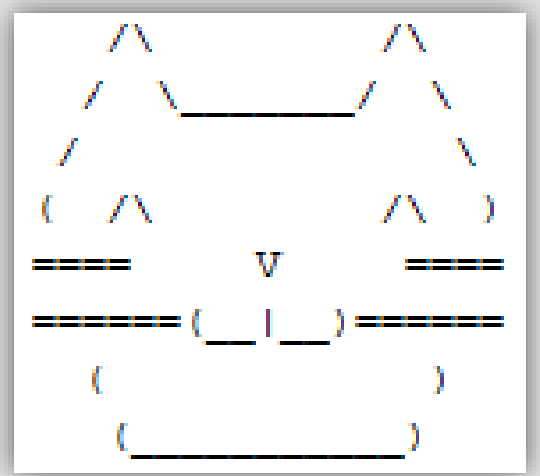
Objectives

- This lesson covers the following objectives:
  - Differentiate between procedural and object-oriented programming
  - Understand a class as a blueprint for an object
  - Understand a class is used to create instances of an object
  - Model objects as a combination of …
    - Properties (data fields)
    - Behaviors (methods)

Review

- So far, we've taken …
  - Decades of computer science innovation
  - Gigabytes of modern computing power

- And much like the Internet …
  - We've made a cat!



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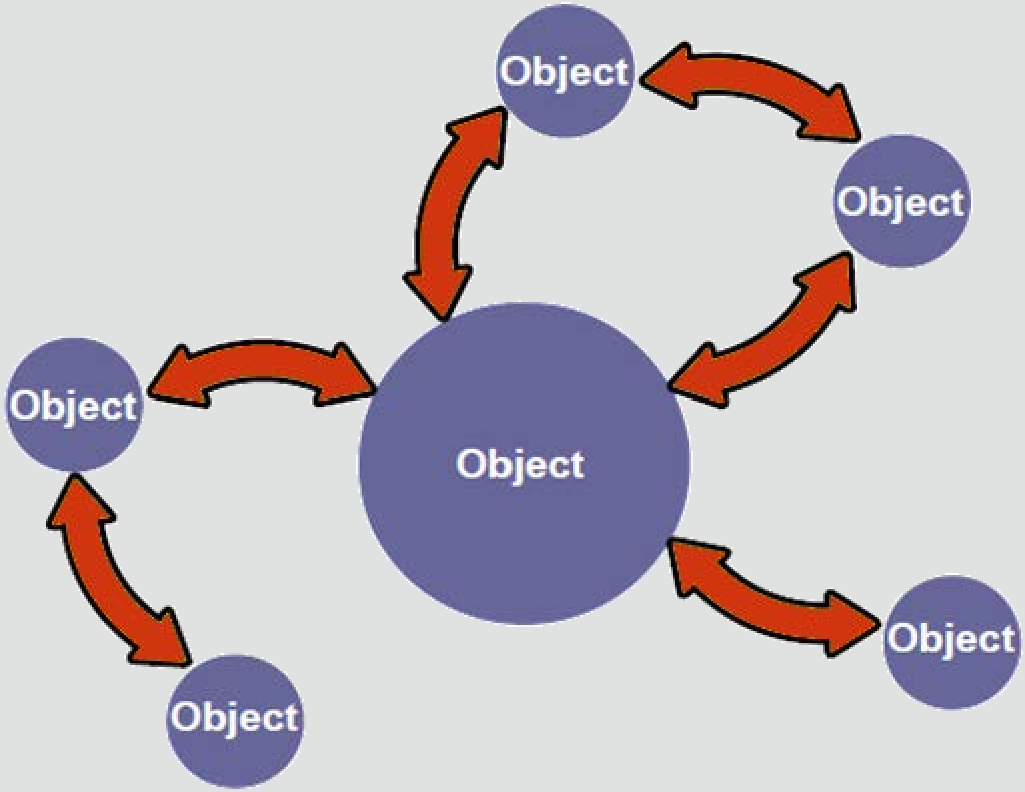
Java Can Do More!

- Procedural languages …
  - Read one line at a time
  - The C language is procedural

- Object-oriented languages…
  - Read one line at a time
  - Model objects through code
  - Emphasize object interaction
  - Allow interaction without a prescribed order
  - Java and C++ are object-oriented languages

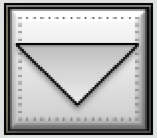
Object-Oriented Programming

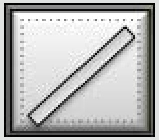
- Interaction of objects
- No prescribed sequence



Exercise 1

- Play Basic Puzzles 1 through 5
  - Your Goal: Design a solution that deflects the ball to Duke
- Consider the following:
  - What objects do you find on the field of play?
  - What happens when you put a triangle wall or simple wall icon on the blue wheel?



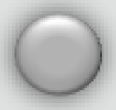


About Java Puzzle Ball

- Play a set of puzzles
- Become familiar with the game mechanics
- Consider questions as you play
- Listen to the lesson's debriefing on what you’ve observed
- Apply your observations to understand Java concepts

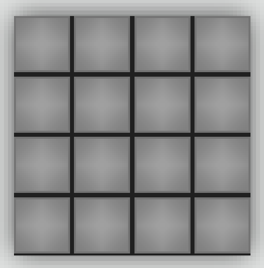
Object Types

- What objects did you find on the field of play?
  - Ball

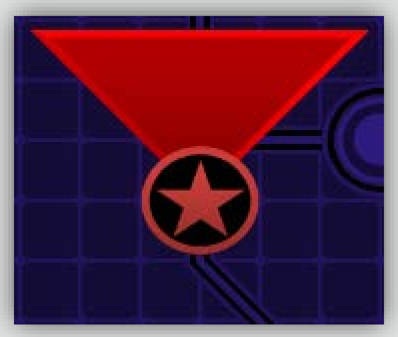


  - Duke

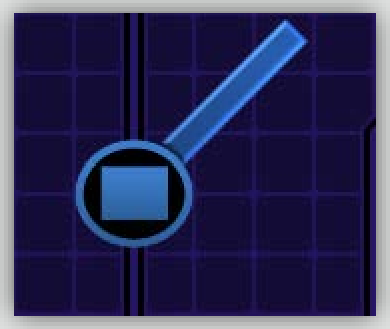
  - LevelGeometry



  - RedBumper

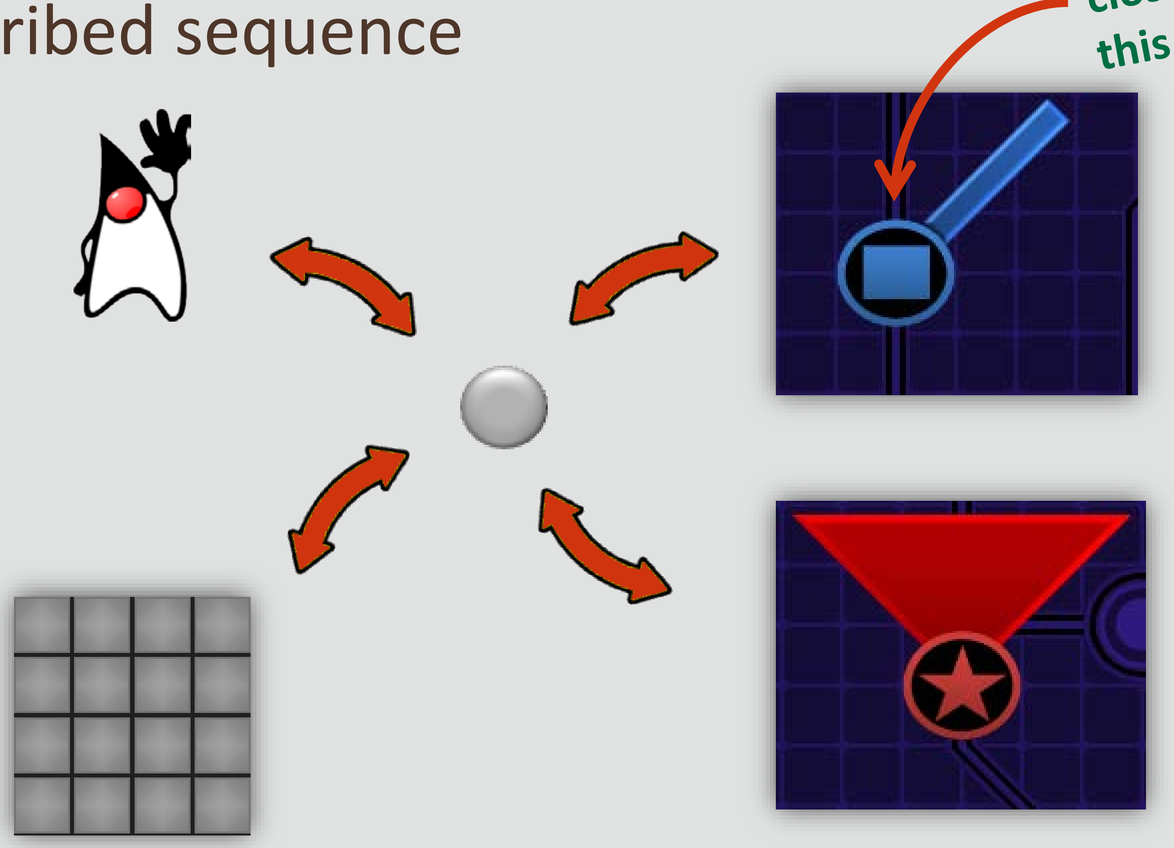


  - BlueBumper



Object Interaction

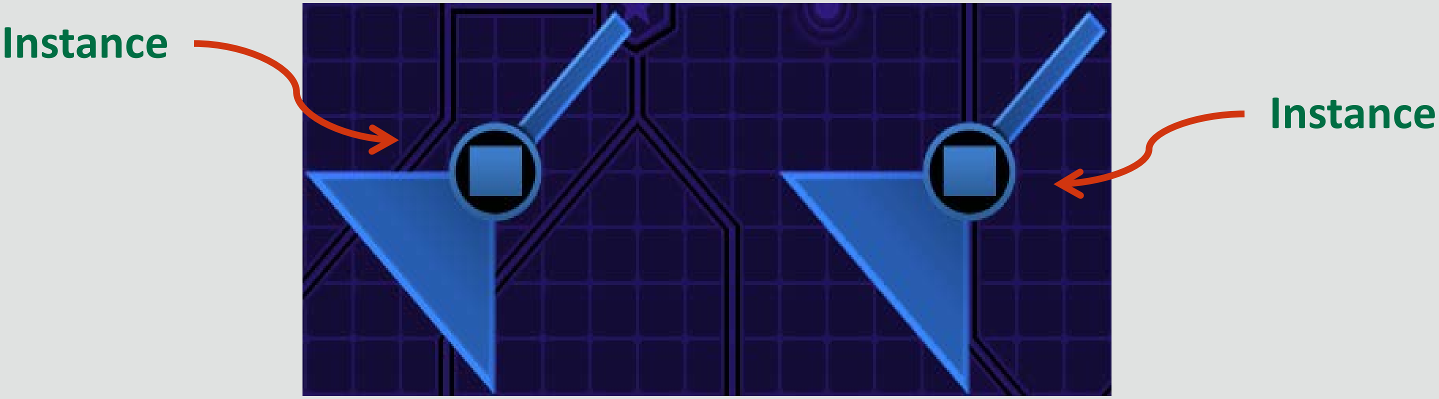
- Interaction of objects
- No prescribed sequence



Let's take a closer look at this object

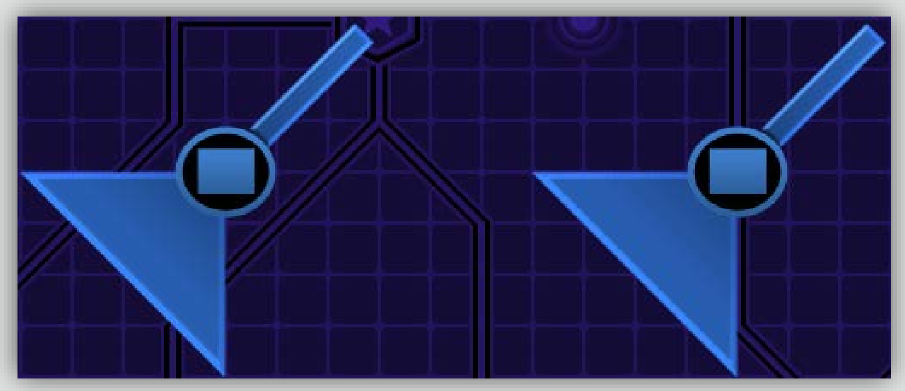
BlueBumper Objects

- What happens when you put a triangle wall or simple wall icon on a blue wheel?
- A wall appears on every instance of a blue bumper object
- Walls give bumpers behaviors that deflect and interact with the ball
- All blue bumper instances share these same behaviors



Describing a BlueBumper

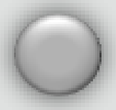
- Properties:
  - Color
  - Shape
  - x-position
  - y-position



- Behaviors:
  - Make ping sound
  - Flash
  - Deflect ball (via Simple Wall)
  - Deflect ball (via Triangle Wall)

Describing a Ball

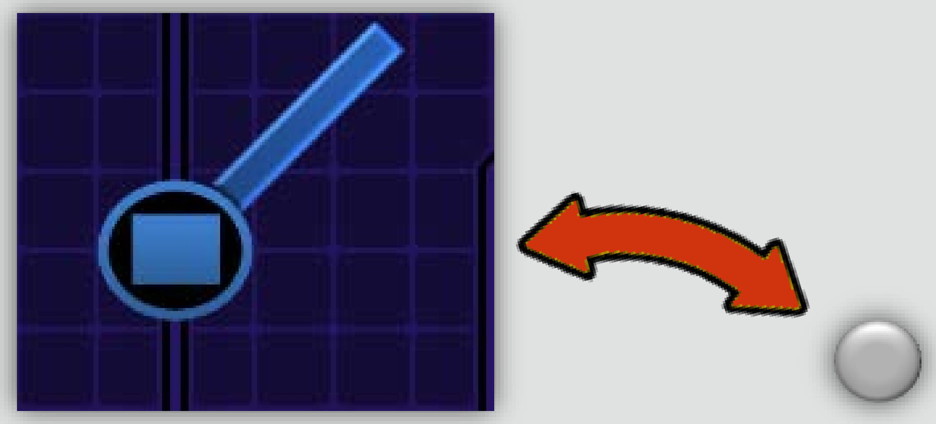
- Properties:
  - Direction
  - x-position
  - y-position



- Behaviors:
  - Make ping sound
  - Change direction
  - Change x-position
  - Change y-position

BlueBumper and Ball Interaction

- Interaction occurs when the BlueBumper deflects the Ball. When this happens …
- The Ball's properties change:
  - The Ball travels in a different direction
  - The Ball's future x-position and y-position change
- The BlueBumper performs behaviors:
  - Makes ping sound
  - Flashes



Why Does This Matter?

- We've observed important aspects of object-oriented programming
- Remember these observations as lessons and exercises become increasingly technical
  - Objects can be described as a combination of properties and behaviors
  - There may be many instances of the same object type
  - All instances of an object share the same behaviors
  - Objects may interact with each other, possibly affecting each other's properties and triggering other behaviors

A Different Example

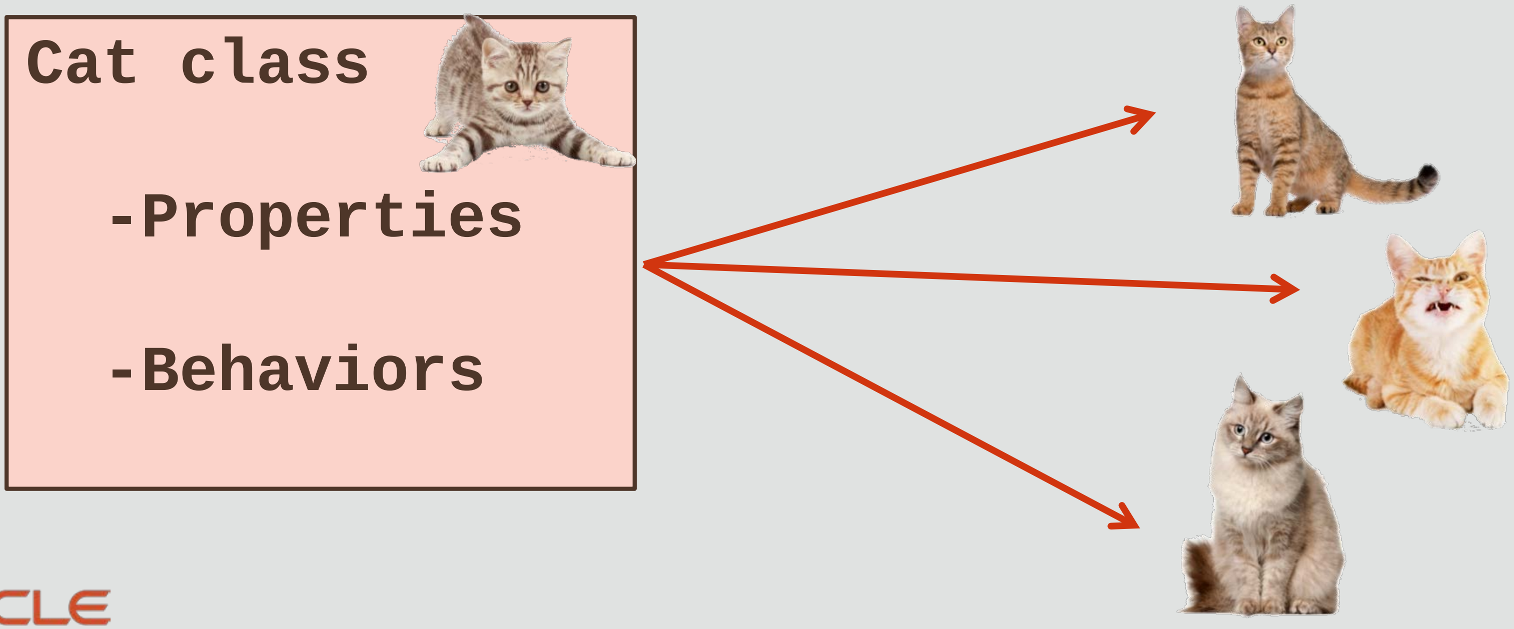
- Properties:
  - Name
  - Age
  - Breed
  - Favorite Food

- Behaviors:
  - Make meow sound
  - Play
  - Wash
  - Eat
  - Hunt

Classes and Instances

- The combination of properties and behaviors is …
  - Called a class
  - A blueprint or recipe for an object
  - Used to create object instances

Object instances

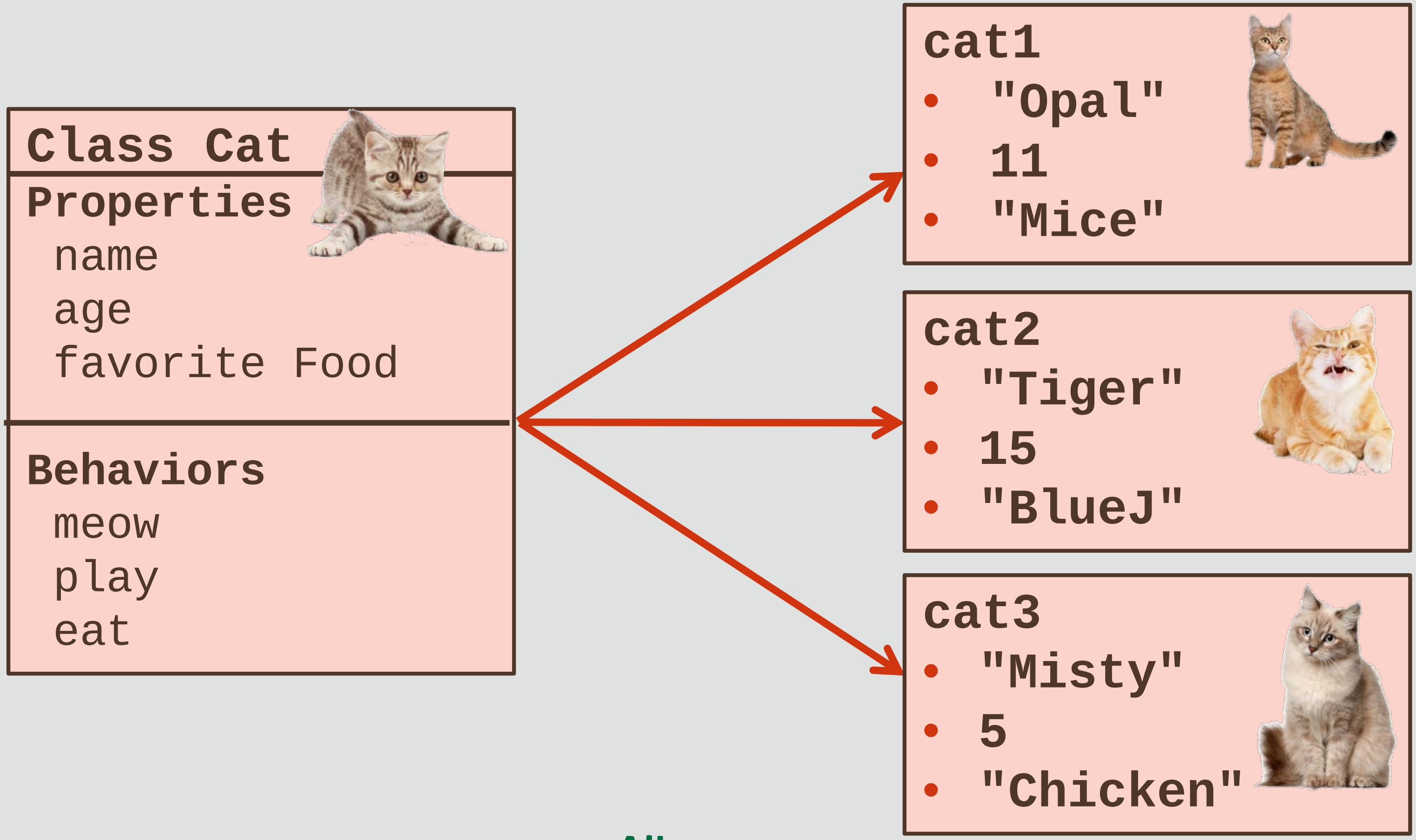


Cat class

-Properties

-Behaviors

Creating New Instances from a Blueprint



Class Cat

Properties
- name
- age
- favorite Food

Behaviors
- meow
- play
- eat

cat1
- "Opal"
- 11
- "Mice"

cat2
- "Tiger"
- 15
- "BlueJ"

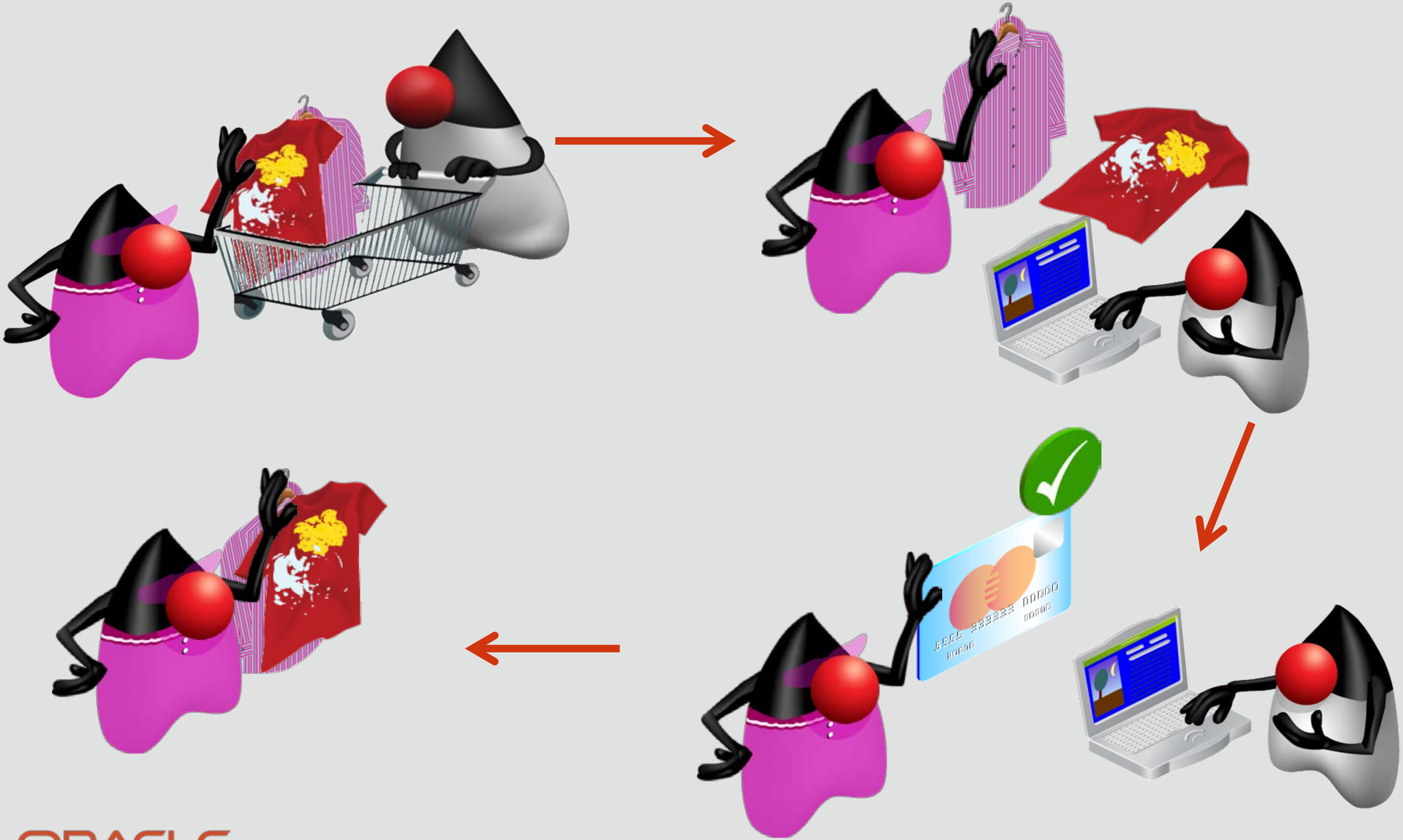
cat3
- "Misty"
- 5
- "Chicken"

All cat instances share the ability to meow, play, and eat

Object-Oriented Strategy

- How do you write programs that achieve this level of flexibility?
- When you have an idea or requirement for a program …
  - Consider what type of objects may exist in this program
  - Consider the properties and behaviors of these object types
  - Consider how objects interact

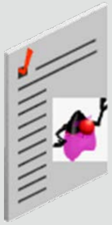
Duke's Choice Online Shopping



Characteristics of Objects

- Objects are physical or conceptual
- Objects have properties:
  - Size
  - Price
  - Color
- Objects have behaviors:
  - Shop
  - Put item in cart
  - Pay

Physical: Shirt

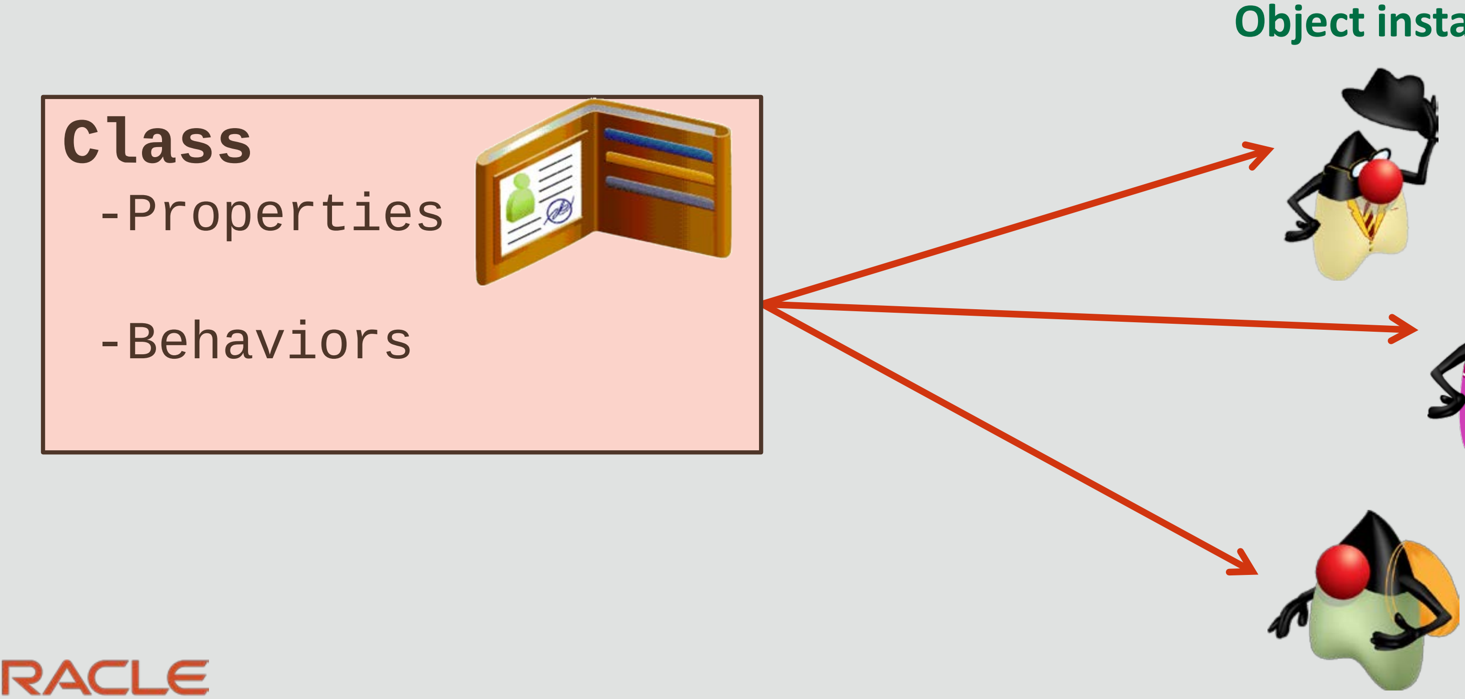

Conceptual: Online Account

Color property value is red

Mrs. Duke

Classes and Instances

- Remember, a class ...
  - Is a blueprint or recipe for an object
  - Describes an object's properties and behaviors
  - Is used to create Object instances



```
Class
 -Properties

 -Behaviors
```

Exercise 2, Part 1

- Given the following scenario, what objects could you potentially model to complete your program?
  - Design a program for a coin-sorting machine
  - This machine should measure, count, and sort coins based on their size or value
  - It should also print a receipt

- List at least 3 objects:
  –
  –
  –

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Exercise 2, Part 2

- Chose an object from Part 1
- What properties and behaviors of this object could you include in your program?

- Properties:
  –
  –
  –

- Behaviors:
  –
  –
  –

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

Translating into Java Syntax

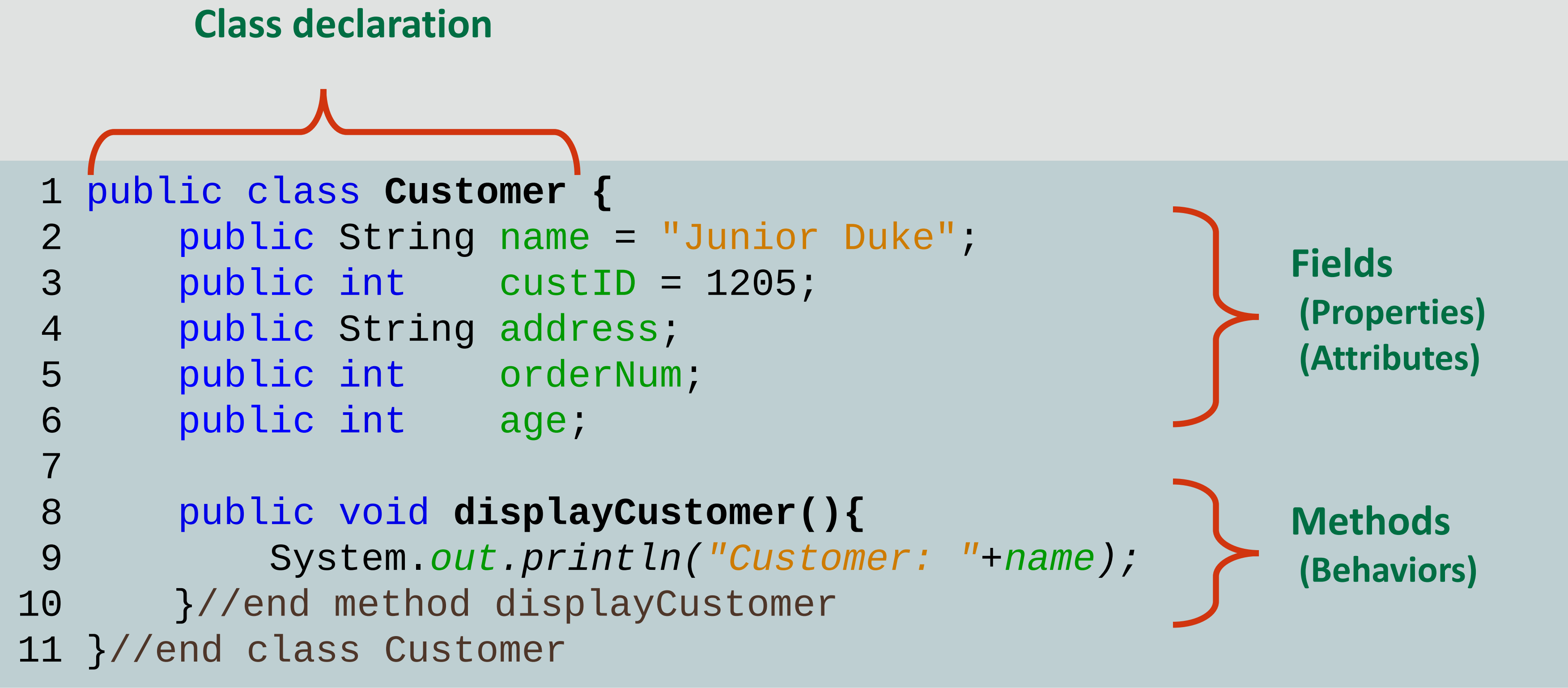
```
public class Customer {

    Properties

    Behaviors

}
```

Java Terminology



```java
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);
    }//end method displayCustomer
}//end class Customer
```

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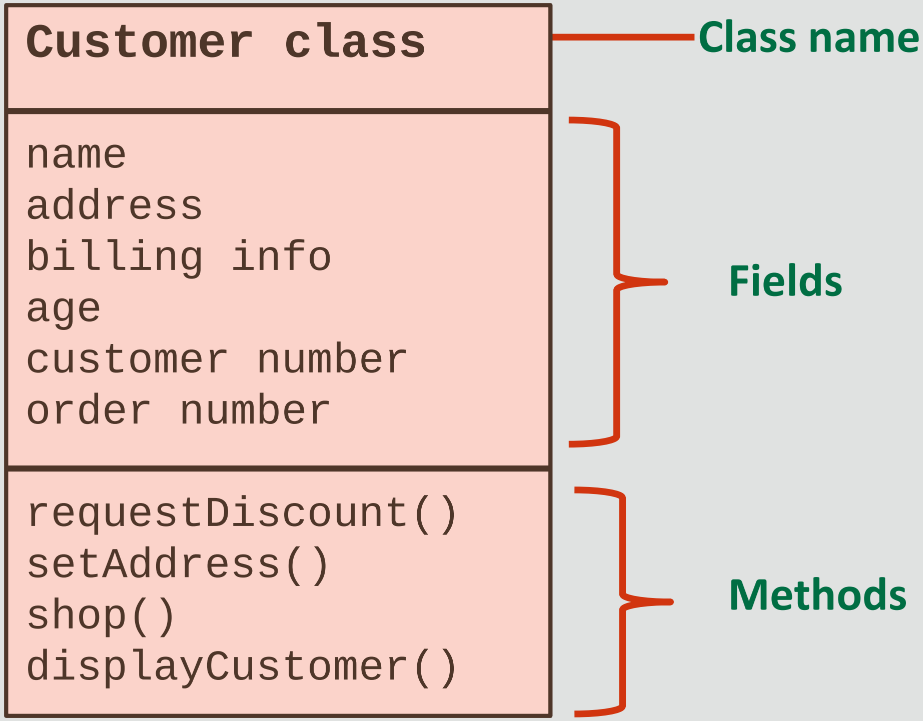
Modeling Properties and Behaviors



Customer class

name
address
billing info
age
customer number
order number

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

Data Fields

- Fields or Data Fields are the official Java terminology
- They're also called:
  - Properties
  - Attributes
  - Data Members
- Java has particular ways of representing data
  - Section 3 will take a closer look at data
  - We'll use the main method for this investigation
  - For now, it's alright to include a lot of code in the main method
  - BUT a large main method is strongly discouraged
  - Section 4 explores how to avoid this scenario

Summary

- In this lesson, you should have learned how to:
  - Differentiate between procedural and object-oriented programming
  - Understand a class as a blueprint for an object
  - Understand a class is used to create instances of an object
  - Model objects as a combination of …
    - Properties (data fields)
    - Behaviors (methods)

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