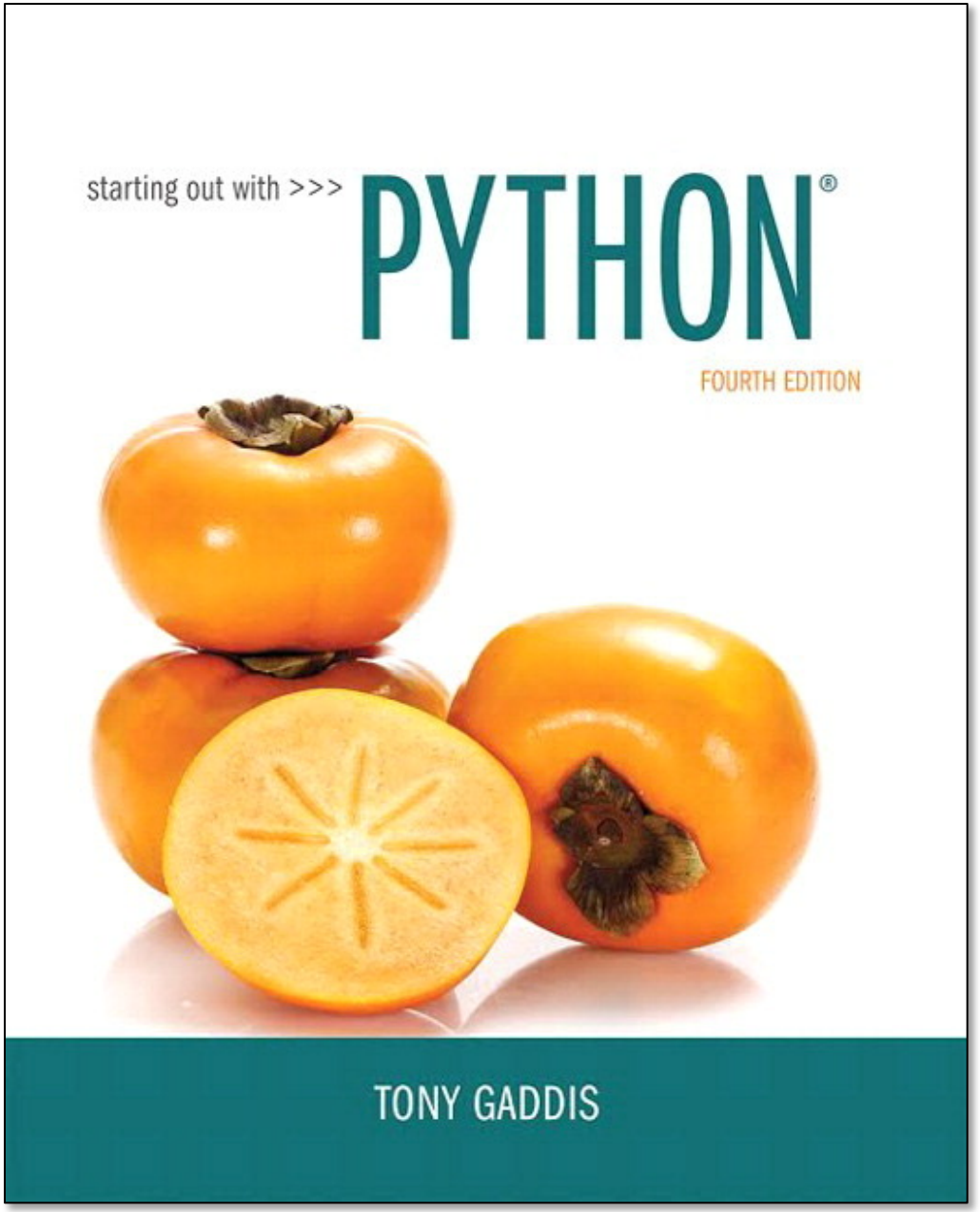
CHAPTER 11

Inheritance



Topics

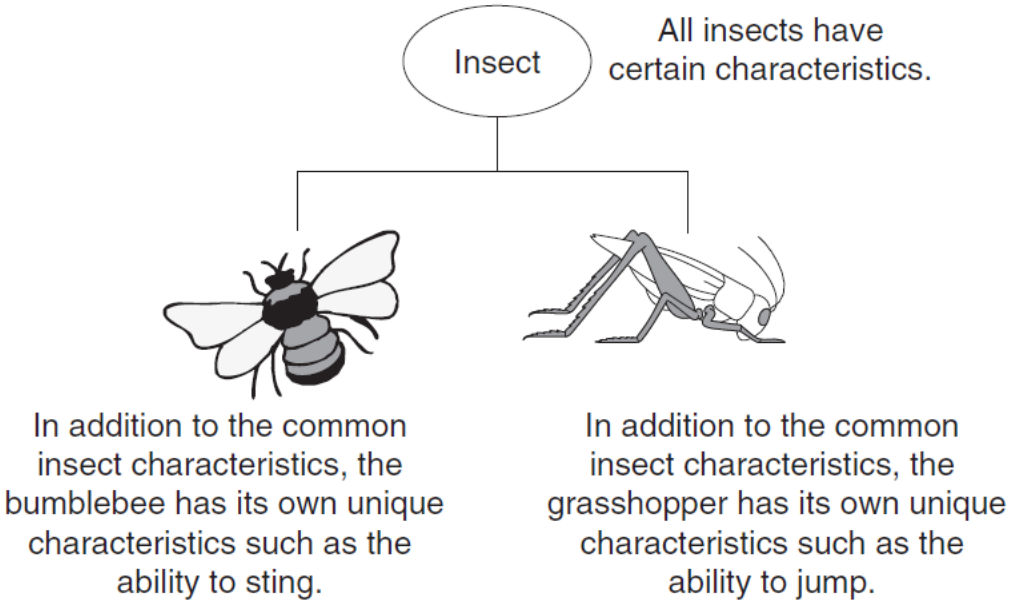
- **Introduction to Inheritance**
- **Polymorphism**

Introduction to Inheritance

- **In the real world, many objects are a specialized version of more general objects**
  - Example: grasshoppers and bees are specialized types of insect
    - In addition to the general insect characteristics, they have unique characteristics:
      - Grasshoppers can jump
      - Bees can sting, make honey, and build hives

Introduction to Inheritance (cont'd.)

Figure 11-1 Bumblebees and grasshoppers are specialized versions of an insect



Inheritance and the "Is a" Relationship

- **"Is a" relationship: exists when one object is a specialized version of another object**
  - Specialized object has all the characteristics of the general object plus unique characteristics
  - Example: Rectangle is a shape

    Daisy is a flower

Inheritance and the "Is a" Relationship (cont'd.)

- **Inheritance: used to create an "is a" relationship between classes**
- **Superclass (base class): a general class**
- **Subclass (derived class): a specialized class**
  - An extended version of the superclass
    - Inherits attributes and methods of the superclass
    - New attributes and methods can be added

Inheritance and the "Is a" Relationship (cont'd.)

- **For example, need to create classes for cars, pickup trucks, and SUVs**
- **All are automobiles**
  - Have a make, year model, mileage, and price
  - This can be the attributes for the base class
- **In addition:**
  - Car has a number of doors
  - Pickup truck has a drive type
  - SUV has a passenger capacity

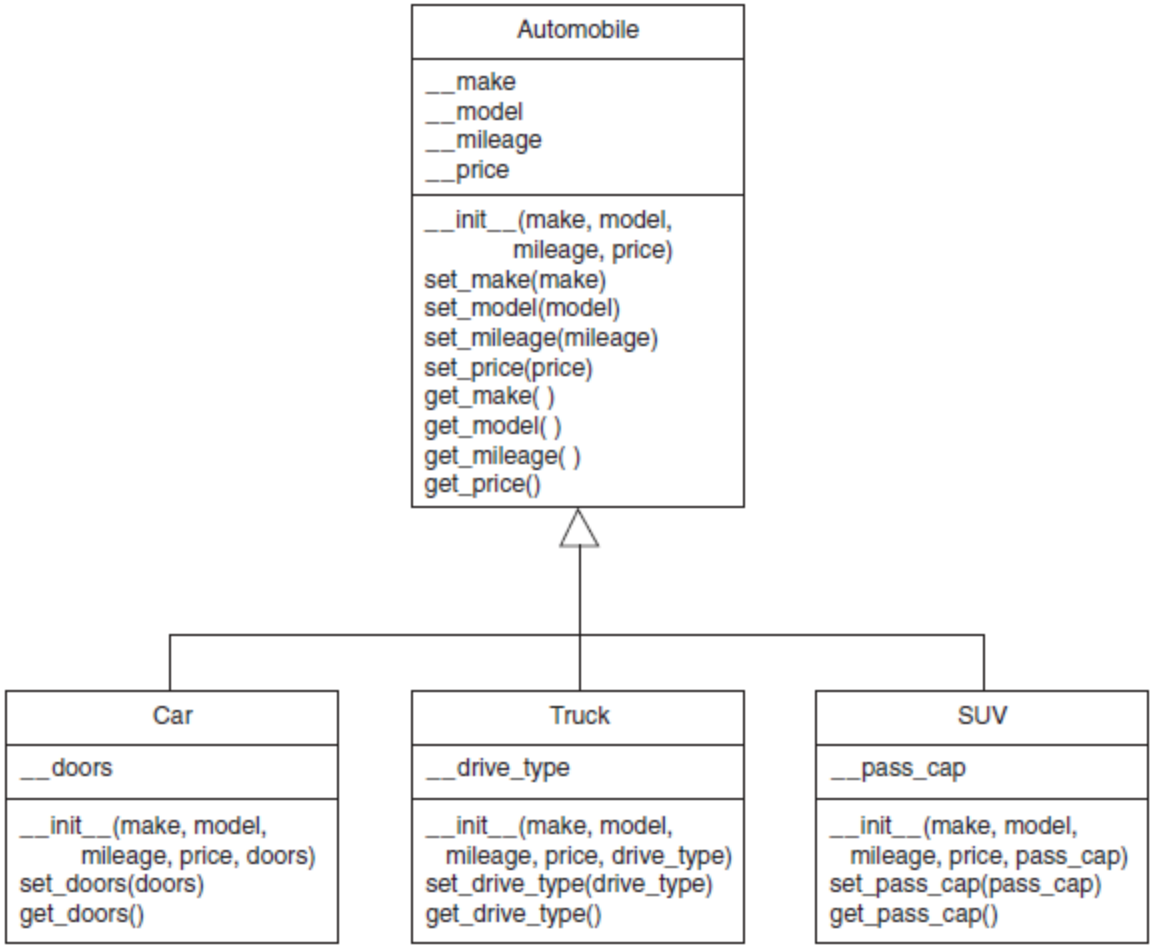
Inheritance and the "Is a" Relationship (cont'd.)

- **In a class definition for a subclass:**
  - To indicate inheritance, the superclass name is placed in parentheses after subclass name
    - Example: `class Car(Automobile):`
  - The initializer method of a subclass calls the initializer method of the superclass and then initializes the unique data attributes
  - Add method definitions for unique methods

Inheritance in UML Diagrams

- **In UML diagram, show inheritance by drawing a line with an open arrowhead from subclass to superclass**

Figure 11-2 UML diagram showing inheritance



Polymorphism

- **Polymorphism: an object's ability to take different forms**
- **Essential ingredients of polymorphic behavior:**
  - Ability to define a method in a superclass and override it in a subclass
    - Subclass defines method with the same name
  - Ability to call the correct version of overridden method depending on the type of object that called for it

Polymorphism (cont'd.)

- **In previous inheritance examples showed how to override the `__init__` method**
  - Called superclass `__init__` method and then added onto that
- **The same can be done for any other method**
  - The method can call the superclass equivalent and add to it, or do something completely different

The `isinstance` Function

- **Polymorphism provides great flexibility when designing programs**
- **`AttributeError` exception: raised when a method is receives an object which is not an instance of the right class**
- **`isinstance` function: determines whether object is an instance of a class**
  - Format: `isinstance(`*`object`*`, `*`class`*`)`

Summary

- **This chapter covered:**
  - Inheritance, including:
    - “Is a” relationships
    - Subclasses and superclasses
    - Defining subclasses and initializer methods
    - Depicting inheritance in UML diagrams
  - Polymorphism
  - The `isinstance` function