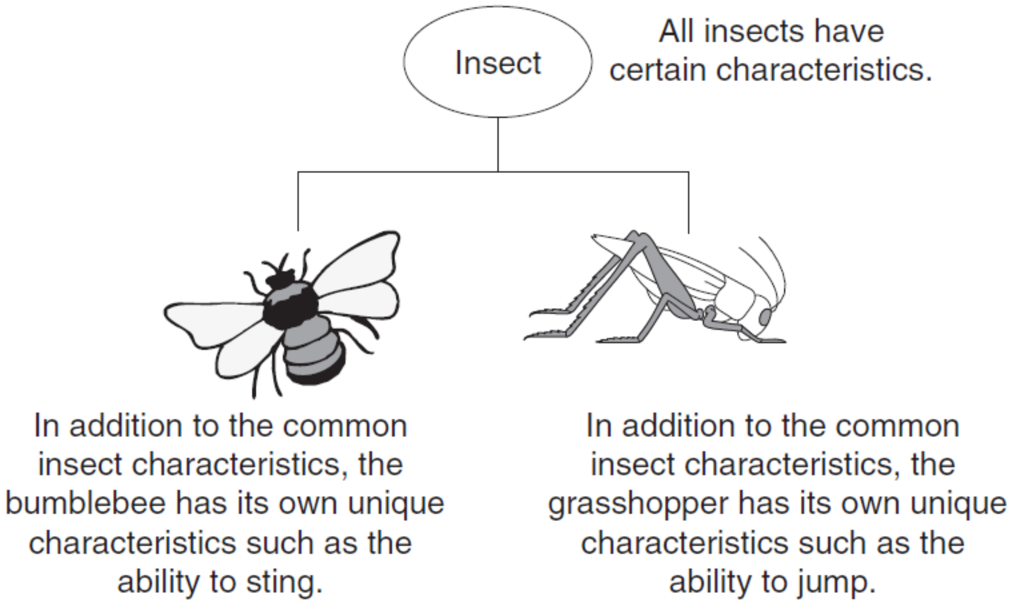
Introduction to Inheritance

- **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


Insect
All insects have certain characteristics.
In addition to the common insect characteristics, the bumblebee has its own unique characteristics such as the ability to sting.
In addition to the common insect characteristics, the grasshopper has its own unique characteristics such as the ability to jump.

Inheritance and the “Is a” Relationship

- **“<u>Is a” relationship</u>: 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

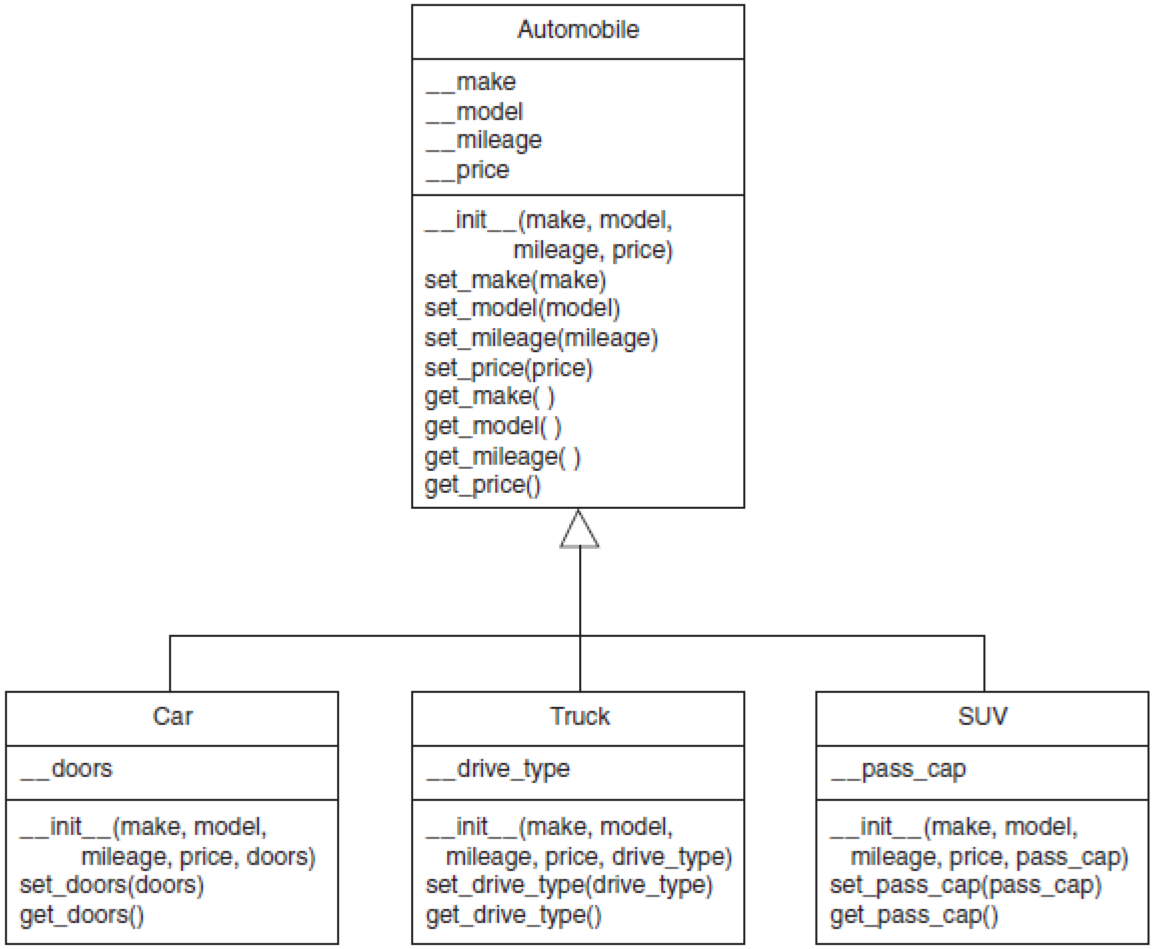
Inheritance and the “Is a” Relationship (cont’d.)

- **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 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`*`)`