

AP Computer Science
Program Set 5
Inheritance, Abstract Classes & Interfaces

P5A. Superhero time! Design three superhero subclasses that inherit from the Superhero superclass. For each of the subclasses, include the following:

- a. at least one instance variable unique to the superhero subclass (along with an upgraded constructor), and/or
- b. at least one new method unique to the subclass, and
- c. override the Superhero `getMotto()` method to return a catchy motto for your superhero.

Write a driver program to perform the following:

- a. Create an `ArrayList` that can hold Superhero objects.
- b. Populate the `ArrayList` with at least one instance of each of your three superhero subclasses.
- c. Use a for loop to polymorphically call the `getMotto()` method for each of your superheros.

P5B. Let's design your own inheritance hierarchy with at least three subclasses. You can choose your own theme...some ideas are musical instruments, movies, sports, spaceships, etc.

- a. Design and implement an inheritance hierarchy that includes a superclass and at least two subclasses. Ensure that each class includes at least one of the following in order to justify the class as a subclass:
 - i. one or more instance variables unique to the subclass (i.e., not found in the superclass) along with the upgraded constructors, and/or
 - ii. one or more unique methods in the subclass, and/or
 - iii. one or more method(s) that override (or overload) methods in the superclass.
- b. Create an array that can hold objects of your superclass type, populate it with at least three instances of the class, and polymorphically call a method from the superclass.
- c. Create an `ArrayList` that can hold objects of your superclass type, populate it with at least three instances of the class, and polymorphically call a method from the superclass.

P5C. AP 2014 #4 Trio

P5D. AP 2005 #2 Ticket

P5E. AP 2016 #1 RandomStringChooser

P5F. AP 2015 #4 NumberGroup

P5G. AP 2012 #3 Horse

Learning Objective Checklist

(please print and complete after you have had all HW Set 5 programs checked off)

Place a check next to those items that you have mastered

- a. Write the Java code to allow class B inherit from class A.

```
public class B extends A
{
}
```
- b. Given a Java inheritance hierarchy, write the Java code to properly abstract out common class elements (instance variables and methods) into a superclass.
- c. Explain that only public data members and/or methods are inherited and that private data members and/or methods are not inherited.
- d. Describe the method call order in a Java inheritance hierarchy.
- e. Describe that class extension (inheritance) is different from class composition (building class from existing classes) and know when to use each technique.
- f. Write Java code to polymorphically process objects that exist in an inheritance hierarchy.
- g. Write Java methods that have polymorphic arguments and return types.
- h. Write the Java code to **override** an existing method.
- i. Write the Java code to **overload** an existing method.