RIT | Golisano College of Computing and Information Sciences
School of Information

Name: _____

ISTE-120
Lab 11: Inheritance

Exercise 1 - Creating the super class (3 points)

Step 1: Create a Boat class that contains information and methods common to all boats. It will be used as a super class in subsequent tasks. It has the attributes and methods shown in the table below. Note carefully, that the parameterized constructor, does not make direct assignments to instance variables (attributes). Rather, it must initialize them using the appropriate mutators.

Attributes	**Data type**
color	A String value for the boat color.
length	An int value for the boat length.
Method	**Description**
Boat	Default constructor that initializes color to white and length to 20.
Boat	A constructor with 2 parameters: a string value for the boat color that initializes color using setColor, and an integer value for the boat length that initializes length using setLength.
setColor	A mutator that tests the input parameter to insure it is white, red, blue or yellow. If so, it sets color and returns **true**. For all other values, color is not set and **false** is returned.
getColor	An accessor that returns the color.
setLength	A mutator that tests the input parameter to ensure it is in the range of 20 to 50 inclusive. If so, it sets length and returns **true**. For all other values, length is not set and **false** is returned.
getLength	An accessor that returns the length.
toString	Returns a string using String.format: Color = *color* Length = *length*

Although not strictly necessary, writing a TestBoat test class to verify the design of Boat is recommended. Note in the sample output below, each mutator was tested with both good and bad data.

```
Select Command Prompt

dkpvcs> java TestBoat
Testing superclass Boat:
Color = blue    Length = 25
Setting Boat's length to 100.
Error: Boats can only be between 20 and 50 feet, inclusively.
Setting Boat's length to 40.
Setting Boat's color to "purple"
Error: Boats can only be white, red, blue and yellow.
Setting Boat's color to "red"
Testing superclass Boat:
Color = red     Length = 40

dkpvcs> _
```

Step 2: Create a SailBoat class using the Boat class as the super class and having the following attributes and methods:

Attributes	**Data type**
numSails	An int that holds the number of sailboat sails
Method	**Description**
SailBoat	The Boat class default constructor that sets the numSails to 1
SailBoat	Constructor with 3 parameters: a String for the boat color, an int for the boat length and an int for the number of sails. The color and the length are passed to the Boat class 2-parameter constructor, while the number of sails is initialized using the setNumSails mutator.
setNumSails	A mutator that tests the input parameter to ensure it is in the range of 1 to 4 inclusive. If so, it sets numSails and returns **true**. For all other values, numSails is not set and **false** is returned.
getNumSails	Returns the int value of numSails
calcPrice	Calculates the price of the SailBoat as follows: length * 1000 + numSails * 2000
toString	Returns a string using String.format: super.toString() + "Number of Sails = " + numSails + " Price = " + calcPrice

Step 3: Create a test class, TestSailBoat, that creates an object of the SailBoat class and prints the output of the toString method. Test the mutators for errors and print appropriate error messages.

Command Prompt

```
dkpvcs> java TestSailBoat
Sailboat:
Color = red     Length = 25      Number Sails = 2        Price = $ 29,000.00

Changing Sailboat's color to "purple"
Error: Boats can only be white, red, blue and yellow.
Setting Boat's color to "yellow"

Changing Sailboat's length to 55.
Error: Boats can only be between 20 and 50 feet, inclusively.
Changing Boat's length to 50.

Sailboat:
Color = yellow  Length = 50      Number Sails = 2        Price = $ 54,000.00

dkpvcs>
```

Submit your .java files to the Lab11 Assignment folder when Exercise 1 is working correctly.

Exercise 2 - Create another subclass (3 points)

Step 1: Create a PowerBoat as a subclass of the Boat class with the following attributes and methods:

Attributes	Data type
engineSize	An int that holds the engine size as engine horsepower
Method	**Description**
PowerBoat	Default constructor that calls the default constructor of the Boat class and sets the size of the engine to 5.
PowerBoat	Constructor with 3 parameters: a String for the boat color, an int for the boat length and an int for the engine size (horsepower). The color and the length are passed to the 2-parameter constructor in the Boat class. The engineSize is initialized using setEngineSize.
setEngineSize	Returns **true** if input is in the range 5 – 350. For all other values, do not set engineSize and return **false**.
getEngineSize	Returns the size of the engine.
calcPrice	Calculates the price of the PowerBoat as follows: 5000 + length * 300 + engineSize of * 20
toString	Returns the string using String.format: super.toString + "Engine Size = " + engineSize + " Price = " + calcPrice.

Step 2: Create a TestPowerBoat that will create an object of the PowerBoat class and print the output of the toString method. Test the mutators for errors and print appropriate error messages. Sample output is as follows:

```
Command Prompt

dkpvcs> java TestPowerBoat
Powerboat:
Color = yellow  Length = 20      Engine Size = 20        Price = $ 11,400.00

Changing Powerboat's color to "purple"
Error: Boats can only be white, red, blue and yellow.
Setting Boat's color to "white"

Changing Powerboat's engine size to 500.
Error: That engine is too powerful. The engine size must be between 1 and 350, inclusively.
Changing PowerBoat's engine size to 350.

Powerboat:
Color = white   Length = 20      Engine Size = 350       Price = $ 18,000.00

dkpvcs>
```

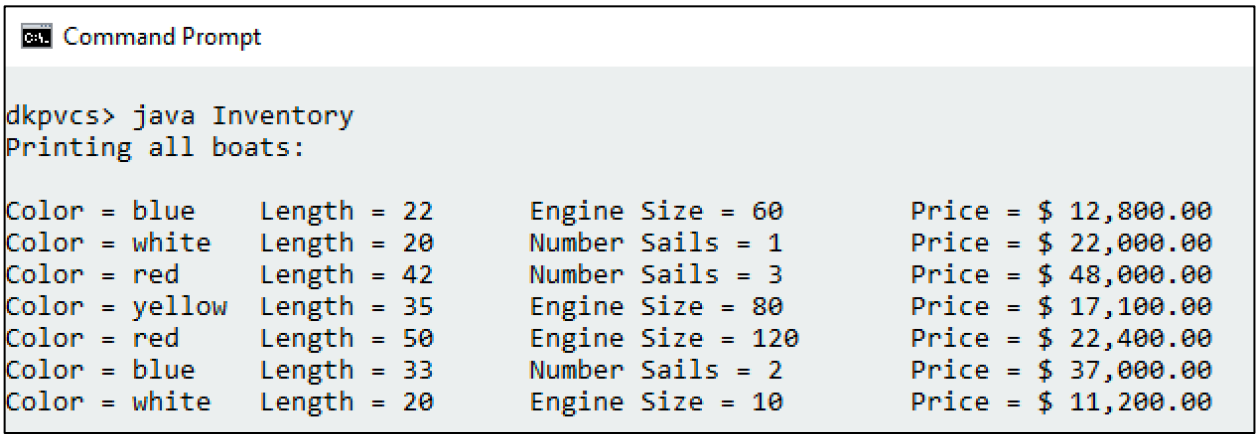
Submit your .java files to the Lab11 Assignment folder when Exercise 2 is working correctly.

Exercise 3 - Create a Collection (Inventory) class (4 points)

Step 1: Create an Inventory test class. Begin by creating an ArrayList that holds objects of any type of Boat. Add the sailboats and powerboats listed below to the collection. The boats can be defined directly with a constructor eliminating the need to write a substantial amount of code that would be required to read in the values of the boats' attributes.

- A 22 ft. blue power boat with a 60 horsepower engine
- An 18 ft. white sail boat with 1 sail
- A 42 ft. red sail boat with a 3 sails
- A 35 ft. yellow power boat with an 80 horsepower engine
- A 50 ft. red power boat with a 120 horsepower engine
- A 33 ft. blue sail boat with 2 sails
- A 14 ft. white power boat with a 10 horsepower engine

A for/each loop must be used to print out all of the sailboats and powerboats as shown below:



Step 2: Add functionality to the test that calculates the total price of all sailboats and powerboats in the collection, finds the most expensive boat and prints the toString information about that boat.

```
Command Prompt

dkpvcs> java Inventory
Printing all boats:

Color = blue    Length = 22      Engine Size = 60        Price = $ 12,800.00
Color = white   Length = 20      Number Sails = 1        Price = $ 22,000.00
Color = red     Length = 42      Number Sails = 3        Price = $ 48,000.00
Color = yellow  Length = 35      Engine Size = 80        Price = $ 17,100.00
Color = red     Length = 50      Engine Size = 120       Price = $ 22,400.00
Color = blue    Length = 33      Number Sails = 2        Price = $ 37,000.00
Color = white   Length = 20      Engine Size = 10        Price = $ 11,200.00

Total price of all boats is $ 170,500.00

Most Expensive Boat:  Color = red     Length = 42      Number Sails = 3        Price = $ 48,000.00
```

Note: A String.format statement applied to all toString returns is required in order to insert commas in the appropriate position.

Submit your .java files to the Lab11 Assignment folder when Exercise 3 is working correctly.