**Data Structures (2028C) -- Spring 2017 – Lab 4**

***Topics covered: Inheritance, Polymorphism and Abstract classes***

*Lab due:* ***Sunday, Feb 11 at 11:55PM for Monday Section***

***Tuesday, Feb 13 at 11:55 PM for Wednesday Section***

**Objective:**

The objective of this Lab is to examine Inheritance, Polymorphism and Abstract classes.

**Task 1:** Create a base class that will be used as the basis for the remainder of the lab.

1. Create a new project.
2. Design a class to abstractly model animals. You may want to read the entire assignment before starting this task.
   1. Include at least 2 attributes along with getters and setters for the attributes.
   2. Create a default constructor and an overload constructor allowing you to set values for all attributes.
   3. Define a virtual function called move. Define a non-virtual function called eat that prints out the string “Yummy!”.
   4. Create the implementation code for the above functions as required.
3. Include in the submission how each member will be available in derived classes (i.e. not available, available if not overridden, etc…). Complete this before moving on to task 2.

**Task 2:** Create 2 classes that inherit from this class.

1. Create a class for fish and horse that inherits from Animal.
2. Fish should have the following features:
   1. Move should be defined as printing out “Just keep swimming.”
   2. Eat should be defined as printing out “Yummy Fish Food.”
   3. Add 1 additional attribute to the fish class. Include a getter and setter.
3. Horse should have the following features:
   1. Move should be defined as printing out “Walk, Trot, Canter, Gallop.”
   2. Eat should be defined as printing out “Yummy grass.”
   3. Add 1 additional attribute for the horse class (different from the fish class). Include a getter and setter.
4. Include in the submission what version of the derived class members will be available in instances of the derived class and in instances of the derived class declared as the base class type. Complete this before moving on to task 3.

**Task 3:** Test the classes.

1. Create a program that tests the classes.
   1. Prompt the user for which class to create and values to set the attributes for that class. Include the option to create a fish or horse as an animal. This may look like:

|  |
| --- |
| Press 1 for an instance of animal.  Press 2 for an instance of fish.  Press 3 for an instance of horse.  Press 4 for an instance of a fish declared as an animal  Press 5 for an instance of a horse declared as an animal |

* 1. Call the move and eat functions from the instance created in step a.
  2. Create a function outside of classes that accepts an animal as a parameter. This function should call the move and eat function of the input parameter.
  3. Call the function from step c.
  4. Ask the user if they wish to continue. If so, loop to step a.

1. Use your test program to test all member functions and ensure the class is working correctly.
2. Include in the lab report a screen shot(s) of the output of a test. Include a discussion of how the actual results compared with the expected results from Task 2.

**Lab Submission:**

1. Write a lab report including the following information:
   1. A description of the objectives/concepts explored in this assignment including why you think they are important to this course and a career in CS and/or Engineering.
   2. The sections from each task indicated to be included in the lab report.
2. Include any special instructions to compile and run those programs.
3. In a group project, submissions should include what each group member has contributed.
4. Package all files in a single zip folder and upload the file to blackboard.

**Lab Grading:**

1. 10% - Lab attendance
2. 15% - Task 1 has been correctly implemented and meets all requirements.
3. 25% - Task 2 has been correctly implemented and meets all requirements.
4. 30% - Task 3 has been correctly implemented and meets all requirements.
5. 20% - Lab report contains all required information and is well written.

If program fails to compile, 0% will be given for that Task.