

## **Homework Assignment #8 – Classes**

### **Reading Assignment:**

Read Chapter 10 in C++ for Engineers & Scientists, 3<sup>rd</sup> Edition, by Bronson

### **Problem Assignment:**

1. Write **class Point** as described below:

- Include data members for x, y, and z coordinates
- Include member functions as described below:
  - Use a constructor to initialize each point to (0,0,0)
  - Prompt the user to enter the coordinates for a point
  - Display a point - with parentheses and commas, such as (2,4,5)
  - Find the distance between two points
  - Determine if two points are equal (return an integer = 1 if they are equal)
- Write a main program to test the class. In particular,
  - Use member functions to enter two points.
  - Display the two points.
  - Use the member function to see if the points are equal. Display a message stating if they are equal or not.
  - If the points are not equal, use a member function to find the distance between the two points. Display the distance.
  - Test the program for two cases (one with equal points and one with non-equal points).
- Use separate header and implementation files in the project

(continued)

2. Use **class Point** again with a different main program. Class point should still have the exact same member functions. You should be able to copy your existing header and implementation files into a new project.
- In addition to the main program and the class (with its member functions), write three non-member functions as follows. Note that the functions may call member functions to perform various subtasks.
    - A function to determine if three points form a triangle. The function should return a 1 if they form a triangle and return a 0 otherwise. In order to form a triangle,
      - No two points can be equal.
      - Find the distance between each pair of points. If the largest of the three distances equals the sum of the other two distances, then the points are on a line.
    - A function to find the perimeter of a triangle formed by three points (if they are not in a line). Again use the member function in class Point to first find the distances.
    - A function to find the area of the triangle formed by three points (if they are not in a line) using the following formula, where a, b, and c are the lengths of the three sides and s is the perimeter of the triangle.

$$Area = \sqrt{s(s-a)(s-b)(s-c)}$$

- Write a main program that tests the the non-member functions as follows:
  1. Declare three objects in class Point.
  2. Prompt the user to enter three points.
  3. Display the points.
  4. Test to see if the points are in a line (display the result).
    - A. If the three points are not in a line, the program should display the perimeter and area of the triangle formed by the points.
    - B. If the points are in a line, the program should display a message that they are in a line and should not attempt to calculate the perimeter or area of the triangle.
- Test the program for the following cases:

| Case | Point 1 | Point 2  | Point 3   |
|------|---------|----------|-----------|
| 1    | (0,0,0) | (2,3,0)  | (6,9,0)   |
| 2    | (0,0,0) | (4,0,0)  | (4.3,0)   |
| 3    | (1,2,3) | (10,8,2) | (12,-1,4) |
| 4    | (1,2,3) | (8,4,2)  | (-6,0,4)  |