COSC 111.003 (Spring 2016)

Assignment 1 (100 Points)

Due date: March 10th, 2017

Question 1 (30 Points)

You have the choice of buying two cars. One is more fuel efficient than the other, but also more expensive. You know the price and fuel efficiency (in miles per gallon, mpg) of both cars. You plan to keep the cars for ten years. Assume, a price of $3 per gallon of gas and usage of 12,000 miles per year. You will pay cash for the car and not worry about financing costs. Which car is the better deal?

(a) Develop an algorithm of the above problem in both **pseudocode and flowchart** based on determining the inputs and outputs, breaking down the problem into smaller tasks, and describe each subtask in pseudocode.

(b) Test your algorithm by working a problem with the following sample values:

Car 1: $25,000, 50 miles/gallon
Car 2: $20,000, 30 miles/gallon

Question 2 (20 Points)

Write a program that prompts the user for two integers and then prints

- The sum
- The difference
- The product
- The average
- The distance (absolute value of the difference)
- The maximum (the larger of the two)
- The minimum (the smaller of the two)

Question 3 (30 Points) Midpoint and Slope between coordinate points.

The midpoint between two coordinates (x_1 y_1) and (x_2 y_2) is the average of the x and y coordinates, i.e.:

$$\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$$

The slope of the line, m, between the coordinates (x_1 y_1) and (x_2 y_2) is given by

$$m = \left(\frac{y_2 - y_1}{x_2 - x_1}\right)$$

Write a program that does the following:

- Stores a value for x_1, x_2, y_1, and y_2. (You may choose non-zero integers between -25 and 25 for all of your coordinate points.)
- Calculates the midpoint and the slope of the line.
- Outputs the midpoint and the slope. A sample of the output is shown below:
    - e.g. The midpoint between (1, 1) and (3, 5) is (2, 3), and the slope is 2.

Question 4 (20 Points)

Newton's law states that the force, F between two bodies of masses M_1 and M_2 is given by:

$$F = k\left(\frac{M_1 M_2}{d^2}\right)$$

In which *k* is the gravitational constant and d is the distance between the bodies. The value of *k* is approximately 6.67 x 10^{-11} m^3 kg^{-1} m^{-2}. Write a program that prompts the user to input the masses of the bodies and the distance between the bodies. The program the outputs the force between bodies.

Tip: Store the *k* value as a named constant and use E-notation. You do not have to store the units of measurement, just the value!