Cornerstone of Engineering
Fall 2020
Northeastern University
College of Engineering
Programming Lab 1
(Due: Sept 25, 2020)

Non-Programming Homework

1. Develop flowcharts for programming homework problem 1.

Programming Homework

1. The slope *m* of the line between the two points (x_1, y_1) and (x_2, y_2) is given by the formula

$$m = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$$

Write a program that will ask the user for the coordinates of two points and do the following:

- Determine if the two points form a line.
- Detect if the line is horizontal and alert the user.
- Detect if the line is vertical and alert the user.
- Calculate the slope of the line segment connecting them, if not 0 or undefined.

Use double-type variables for storing the coordinates and calculations made from them.

Sample Run:

Enter the coordinates of point 1 (x, y): **3 8**
Enter the coordinates of point 2 (x, y): **3 8**
Alert! These points do not form a line.

Sample Run:

Enter the coordinates of point 1 (x, y): **3 3**
Enter the coordinates of point 2 (x, y): **7 8**
The slope of the line is 1.25

Sample Run:

Enter the coordinates of point 1 (x, y): **-2 9**
Enter the coordinates of point 2 (x, y): **4 9**
Alert! The line is horizontal.

Sample Run:

Enter the coordinates of point 1 (x, y): **5 -6**
Enter the coordinates of point 2 (x, y): **5 9**
Alert! The line is vertical.

Next modify the program to print the equation of the line in slope-intercept form ($y = mx + b$). Use the appropriate "*y* = " and "*x* = " for horizontal and vertical lines, respectively.

Sample Run:

Enter the coordinates of point 1 (x, y): **3 5**
Enter the coordinates of point 2 (x, y): **5 8**
The slope of the line is 1.50
The slope-intercept form is y = 1.50x + .50

Hint:

To format a variable to two decimal places, include the header file iomanip and use these cout class manipulators:

```
cout << setiosflags(ios_base::fixed)       // do not use E notation
    << setiosflags(ios_base::showpoint)  // always show decimal point
    << setprecision(2);                  // rounded to 2 decimal places
```

Placing the above code at the beginning of your program, inside int main(), forces the formatting to occur throughout the running of your program.

2. Write a program that asks the user to enter the number of atoms of each of the five elements for an amino acid. Then compute and print the molecular weight for this amino acid. The molecular weights for oxygen, carbon, nitrogen, sulfur, and hydrogen are

Oxygen	15.9994
Carbon	12.011
Nitrogen	14.00674
Sulfur	32.066
Hydrogen	1.00794

3. Write a C++ program that asks the user to enter up to a *5-digit positive integer* number and then reverses the order of the digits. The program outputs both numbers and their square roots. An example of the execution of the problem is shown below. Your program should work for 5-digits, 4-digits, 3-digits, 2-digits and 1-digit.

   Please enter a 5-digits integer: (*user inputs 12345*)
   The square root of 12345 is: *111.108*
   The number in reverse is: *54321*
   The square root of 54321 is: *233.068*

4. (Optional: Extra credit -10%)
   (a) Write a C++ program to find a 5-digit number that reverses the order of its digits when multiplied by 4.
   (b) How many 5-digits numbers are there in which the sum of the digits is even.

To Turn In via Blackboard:

1. Word file with Cover page, answer non-programming homework / questions, Screen Capture of outputs, and Results and Discussion
2. Source code e-file (upload to the blackboard, the source code should be saved as phw11_xxx.cpp, phw12_xxx.cpp, …etc., where xxx is your initial)