**Lab Experience 2**

**Lab Exercises Name: Johnathan Lee**

**Section: 01**

**Problem 1: Fill in the blank:**

Answer the following questions based upon material presented in lecture and found in chapters 2 and 3 of your textbook.

1. What is the final value of the following expression:

* 1. Evaluate the expression using your calculator.

(5 – 15 /2 \* 3 + (3 + 2 / 4)) – 5 Answer: **-19**

* 1. Evaluate the expression the way C++ would do the evaluation.

(5 – 15 /2 \* 3 + (3 + 2 / 4)) – 5 Answer: **(5-7\*3+(3+0))-5=(5-21+5)-5=5-21= -18**

1. Write the following expression in C++ format. The cmath library contains a built-in function called square root and it’s format is **sqrt(expression).** In all programming languages all operations must be explicitly defined. For example, it is common in algebra to have 3x + 2y. This has to be expressed in C++ as follows: 3 \* x + 2 \* y, otherwise it would be classified as an unknown identifier. In addition, C++ does not have exponentiation operator. Therefore, c2 should be written as c \* c.

C++ Expression: **E = (m \* c \* c)/(sqrt(1 - (v \* v / (c \* c)))**

3. What is the preprocessor directive that must be included for cin and cout to be used in a C++ program?

Answer: **#include <iostream>**

4. Blank spaces, tabs, and newlines in an input line or data file are referred to as **whitespace**.

5. The << in a cout statement is called the **stream insertion** operator.

6. The ‘\n’ is a special character called **newline** character.

7. The >> in a cin statement is called the **stream extraction** operator.

**Problem 2:**

1. Start Visual Studio.
2. Create a new project solution or use an old project solution.
3. Download the program listed below from D2L. .
4. Add the following program into

// Written By Tim Wrenn

// Class: Computer Science 1106

// Lab 2 Program

// Program to convert Fahrenheit temperature to centigrade

#include <iostream>

#include <iomanip>

using namespace std;

int main(){

double tempCentigrade, // temperature in centigrade

tempFahrenheit; // temperature in Fahrenheit

// Request input from user

cout<< "\nPlease enter the temperature in Fahrenheit that "

<< "you wish to convert: ";

cin >> tempFahrenheit;

// Perform conversion

tempCentigrade = 5/9 \* (tempFahrenheit - 32);

// Display results

cout << "\n\n" << tempFahrenheit << " degrees Fahrenheit is equal to ";

cout << fixed << showpoint << setprecision(1);

cout << tempCentigrade << " degrees centigrade.\n\n";

return 0;

}

Answer the following questions by using the program above.

1. Fix all syntax errors (if there are any).

**No syntax errors to fix.**

1. Execute the program using the values in the tempFahrenheit column as input into your program and recording your results under the tempCentigrade column. Use a calculator to perform the same calculation. This is called white box testing.

|  |  |  |
| --- | --- | --- |
| tempFahrenheit | tempCentigrade | Calculator Result |
| 5 | -0.0 | -15 |
| 32 | 0.0 | 0 |
| -5 | -0.0 | -20.55556 |
| 30 | -0.0 | -1.111 |

Does the calculator result match the result from the program? **No.**

Change the equation tempCentigrade = 5/9 \* (tempFahrenheit - 32); to

tempCentigrade = (tempFahrenheit - 32) \* 5/9 ;

and re-run your program and record your results below:

|  |  |  |
| --- | --- | --- |
| tempFahrenheit | tempCentigrade | Calculator Result |
| 5 | -15.0 | -15 |
| 32 | 0.0 | 0 |
| -5 | -20.6 | -20.5555556 |
| 30 | -1.1 | -1.111 |

Does the calculator result match the result from the program? **Yes, though with different rounding points.**

Why does the calculator result match your program’s results? Explain your answer using C++ terminology and Computer Science terminology. Hint: it has something to do with type promotion and demotion.

**It gives different results because C++ was reading it left to right. In the original program, the compiler saw and divided 2 ints, giving an answer of 0 which was then promoted to the double 0.0 to be multiplied by the next part. As 0 \* anything is 0, this resulted in a logic error that made all outputs 0. In the revised program, moving 5/9 to the right of the float caused the compiler to see a multiplication by 5 which was immediately promoted to a double. This was then divided by 9, which was promoted to a double because the numerator was already a double.**

**Due Dates:** According to the due date posted for the assignment folder.

**What to hand in:**

1. Save the word document using your name and the lab number, i.e. timwrennlab2.docx
2. Place the word document into the Lab Two assignment folder in D2L.
3. Hand in a print out of that portion of the word document containing your answers.