Assignment 1 CMPT 125

INDIVIDUAL ASSIGNMENT: NO COLLABORATION PERMITTED

SUBMISSION

This assignment consists of three problems. For each problem you will submit 1 text file containing the commented C code that solves that problem.
For the first problem you will submit a file with the name temperature.c.
For the second problem you will submit a file with the name table.c.
For the third problem you will submit a file with the name prism.c.

MARKING SCHEME

80% of the marks for each problem will be based on the results produced by running your code for a series of tests.

- Most of these tests will be provided with the problem (in this document)
- Some tests will be added for grading and will be provided when your graded assignment is returned.
- Any functionality, constraint or other specification of the program requested in the problem description in this document may be tested when the code is graded.
- Some functionalities, constraints, or other specifications of any program described in this document may not be tested by the provided tests.

20% of the marks will be for direct examination of the code. This will include points for

- Following the class coding standard. (see file posted with this assignment)
- Implementation of specific portions of the solution.

EXPECTATIONS FOR EACH PROBLEM

1. The description of each problem (in this document) will include a series of tests.
   a. Each test will specify, in red, the values input to your code.
   b. For this assignment no input verification should be done. You may assume that only valid input is provided by the user of your program.
   c. Each test will also specify all the expected output values and the formatting of the prompts, inputs and outputs that your code will be expected to produce
2. For each test included in each problem, at least one file containing the expected results of running your program will be posted. These files will define the expected details of spacing and other formatting for each test and the expected values of each output.
3. Your output for a test and the provided output, for the same test, must match character by character to receive full marks for a test. Please watch the short video tutorial "Checking your outputs" for the details of how to compare your output to the corresponding provided output file.

You will use the environment specified below to build your solutions to assignments. Why we need a common environment and how to access the environment four this course is explained in the "Remote Access tutorial".
ENVIRONMENT: Ubuntu 22.04, gcc 11.4.0, gdb 12.1, vscode 1.82.2 (may be updated before 1st class)

PROBLEM 1 (35 POINTS):

Write a C program, including comments. Your program should calculate the temperature in a freezer. There has been a power failure. Since the power failed, the temperature in the freezer has been increasing. Calculate the present temperature (°C) in the freezer based on the following information:

- The temperature in the freezer was T_{start}= -10.2 °C when the power failed.
- The temperature of the room the freezer is in is T_{room}= 21.8 °C.
- The power failure occurred a time $T_{AfterPowOff}$ hours ago
  - The program will need the number of full hours since the power failed and the number of minutes (in addition to the full hours) since the power failed (both integer values)
  - Based on these two integer values, the program will calculate the floating-point number of hours, $T_{AfterPowOff.}$
- The temperature in the freezer cannot be higher than the temperature in the room containing the freezer.
- During the period that temperature in the freezer increases from the starting temperature to the temperature of the room in which the freezer is located, the temperature in the freezer can be determined by using the equation

$$t = T_{start} + 0.05 * T_{AfterPowOff} * (T_{room} - T_{start})$$

Print the estimated temperature in the freezer as shown in the outputs of the tests below.

TEST 1 negative temperature in freezer

```
enter the number of full hours since the power failed: 5
enter the number of additional minutes since the power failed: 21
The power has been off for   5.35 hours
Estimated present temperature in freezer is  -1.64 degrees Celsius
```

TEST 2 positive temperature in freezer

```
enter the number of full hours since the power failed: 17
enter the number of additional minutes since the power failed: 51
The power has been off for  17.85 hours
Estimated present temperature in freezer is  18.36 degrees Celsius
```

TEST 3 time after reaching maximum temperature

```
enter the number of full hours since the power failed: 21
enter the number of additional minutes since the power failed: 14
The power has been off for  21.23 hours
Estimated present temperature in freezer is  21.80 degrees Celsius
```

PROBLEM 2 (35 POINTS): You will be given a framework for this problem. Please write only the missing blocks of code indicated in the framework.

The program should produce a table with 3 columns, one column for angle in degrees, one column for the sine of that angle, and one column for the cosine of that angle.

- The angles should be printed as floating-point numbers with two digits following the decimal point
- The sines and cosines should be printed as floating-point numbers with four digits following the decimal point.
- Each column must be 14 characters wide.
- Each column must have a label indicating what it holds in the top row of the table.
- Numbers and titles in each column should be aligned as shown in the tests.
- The program should request that the user provide
    - the number of rows in the table (maximum being the number of rows on a page = 35),
    - the starting angle
    - the change in angle between successive rows.

Use the framework for the program provided in file maketableFrame.c.

TEST 1

```
Enter the number of rows in the table to be produced
The number of rows must be between 0 and 35
5
Enter the starting angle in degrees (e.g. 3.45)
30.05
Enter increment in angle between rows in degrees (e.g. 0.5)
0.05

         Angle          Sine        Cosine
         30.05        0.5008        0.8656
         30.10        0.5015        0.8652
         30.15        0.5023        0.8647
         30.20        0.5030        0.8643
         30.25        0.5038        0.8638
```

TEST 2

```
Enter the number of rows in the table to be produced
The number of rows must be between 0 and 35
7
Enter the starting angle in degrees (e.g. 3.45)
-33.5
Enter increment in angle between rows in degrees (e.g. 0.5)
11.3

        Angle          Sine        Cosine
       -33.50       -0.5519        0.8339
       -22.20       -0.3778        0.9259
       -10.90       -0.1891        0.9820
         0.40        0.0070        1.0000
        11.70        0.2028        0.9792
        23.00        0.3907        0.9205
        34.30        0.5635        0.8261
```

TEST 3

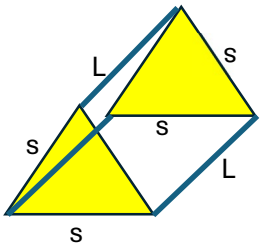
```
Enter the number of rows in the table to be produced
The number of rows must be between 0 and 35
8
Enter the starting angle in degrees (e.g. 3.45)
654
Enter increment in angle between rows in degrees (e.g. 0.5)
-25

        Angle          Sine        Cosine
      654.00       -0.9135        0.4067
      629.00       -0.9998       -0.0175
      604.00       -0.8988       -0.4384
      579.00       -0.6293       -0.7771
      554.00       -0.2419       -0.9703
      529.00        0.1908       -0.9816
      504.00        0.5878       -0.8090
      479.00        0.8746       -0.4848
```

PROBLEM 3 (30 POINTS):

Consider a regular triangular prism as shown in the diagram.
Each end of the prism is an equilateral triangle with sideLength=s.
The prism has a length=L. L and s are measured in cm.
Write a C program to calculate the volume of the triangular prism.

prismVolume = L * s * s * $\sqrt{3}$ / 4.0



TEST 1

```
enter the length of each side of the equilateral triangle: 15.3
enter the length of the triangular prism: 24.8
The volume of the triangular prism is 2513.83 cubic centimeters
```

TEST 2

```
enter the length of each side of the equilateral triangle: 6
enter the length of the triangular prism: 44
The volume of the triangular prism is 685.89 cubic centimeters
```