Fall 2022-Programming Assignment 2

Due Date: 10/30/2022

Repetition Loop Statements

Objectives:

- Write a program that uses conditional statements and I/O.
- Write Repetition statement using Loop
- Display output in a tabular format
- Write program for a mathematical equation
- Compile, test, and debug your program.

Tasks:

1. Create a source code file, using Template 1 (main only).
2. Use the given Van der Waals equation of state of a gas to find the pressure of a given amount of Carbon dioxide at a given temperature

$$\left(P + \frac{an^2}{V^2}\right)(V - bn) = nRT$$

3. Use the debugger to step through the program.
4. Execution of your program output a table that varies the volume of the gas from the initial to the final volume in steps prescribed by the volume increment.

Note: Your program should display the following prompt before imputing Quantity of carbon, dioxide, Temperature, Initial volume, Final volume, and Volume increment from the keyboard.

```
" Please enter at the prompts the number of moles of carbon
dioxide, the absolute temperature, the initial volume in
milliliters, the final volume, and the increment volume
between lines of the table. "
```

Inputs required from keyboard are during execution

- Quantity of carbon dioxide (moles):
- Temperature (kelvin):
- Initial volume (milliliters):
- Final volume (milliliters):
- Volume increment (milliliters):

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Question statement

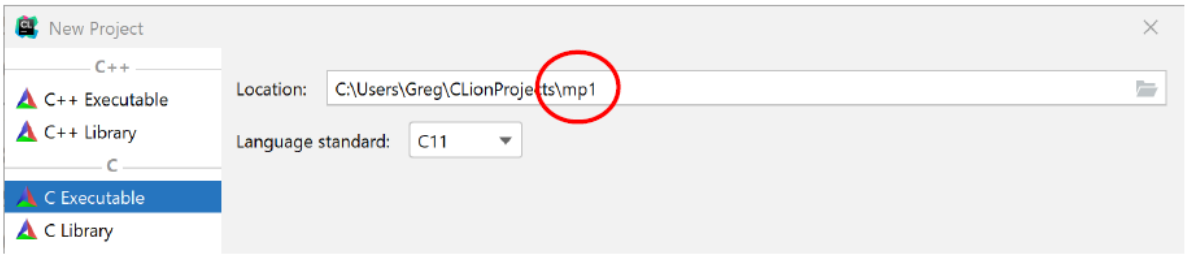
The pressure of a gas changes as the volume and temperature of the gas vary. Write a program that uses the Van der Waals equation of state for a gas,

$$\left(P + \frac{an^2}{V^2}\right)(V - bn) = nRT$$

to create a file that displays in tabular form the relationship between the pressure and the volume of n moles of carbon dioxide at a constant absolute temperature (T). P is the pressure in atmospheres and V is the volume in liters. The Van der Waals constants for carbon dioxide are a = 3.592 $L^2 \cdot atm/mol^2$ and b = 0.0427 L/mol. Use 0.08206 L · atm/mol · K for the gas constant R. Inputs to the program include n, the Kelvin temperature, the initial and final volumes in milliliters, and the volume increment between lines of the table. Your program will output a table that varies the volume of the gas from the initial to the final volume in steps prescribed by the volume increment.

Task 1: Create a C Source Code File

In CLion, create a New Project (under the File menu). The type is “C Executable” and the Language Standard is “C11”. Replace the "untitled" in the project name with a name of your choosing, such as PS2. The project name is the directory (folder) where all of your project files will be stored. It will be easier to locate the files later if you give your projects meaningful names.



Note: Pay attention to the full pathname of your project. This tells you where the project files are located, which will be needed later when you submit files.

CLion will automatically create a file named main.c, and will put a “Hello, World!” print statement in the main function. If this is your first time using CLion, build and run the project to make sure your environment is set up properly. (Click on the green triangle at the top right of the window.) You should see “Hello, World!” printed in the output area.

Hint: If you submit this file as is, you’ll get 50 points!!

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Note: Add a comment at the top of your file that includes your name. Ideally, this program header would also contain information about what the program does and how to run it, but for problem sessions, just your name will be enough.

Template:

```
#include <stdio.h>
#define LITER 0.001                    // converting milliliters to liters


int main(void)
{
    double moles;                        // amount of carbon dioxide
    double press;                        // pressure of carbon dioxide
    double temp;                        // temperature value for volume
    double first_vol;                    // initial volume of CO2
    double final_vol;                    // final volume of CO2
    double step;                         // increment value for volume
    double count_vol;                    // loop control variable

   //Display user instructions

    printf("\nPlease enter at the prompts the number of moles of carbon ");
    printf("dioxide,\nthe absolute temperature, the initial volume in ");
    printf("milliliters, the\nfinal volume, and the increment volume ");
    printf("between lines of the table.");

     /*
            Add You code here

     */

    return (0);
}
```


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Sample run 1: (50 point)

```
Please enter at the prompts the number of moles of carbon dioxide,
the absolute temperature, the initial volume in milliliters, the
final volume, and the increment volume between lines of the table.

Amount of Carbon Dioxide(moles): 0.03
 Temperature (Kelvins):400
 Initial volume(milliliters):600
 Final volume(milliliters):800
 Volume increment(milliliters):60


0.0300 moles of carbon dioxide
at an absolute temperature of 400.00 degrees

  Volume          Pressure
  (milliliters)   (atmospheres)
    600.00            1.6357
    660.00            1.4875
    720.00            1.3639
    780.00            1.2592
```

Sample run 2: (50 point)

```
Please enter at the prompts the number of moles of carbon dioxide,
the absolute temperature, the initial volume in milliliters, the
final volume, and the increment volume between lines of the table.

Amount of Carbon Dioxide(moles):0.02
 Temperature (Kelvins): 300
 Initial volume(milliliters): 400
 Final volume(milliliters): 600
 Volume increment(milliliters): 50


0.0200 moles of carbon dioxide
at an absolute temperature of 300.00 degrees

  Volume          Pressure
  (milliliters)   (atmospheres)
    400.00            1.2246
    450.00            1.0891
    500.00            0.9807
    550.00            0.8918
    600.00            0.8178
```


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