Background
The same problems that were solved in MATLAB can easily be solved using the C programming language. For this assignment you will be converting a MATLAB program into a C program.

Part 1)

Background
The natural frequency, ω_n, is the frequency at which a system will vibrate when it is set into motion. It is a value that mechanical, civil and aerospace engineers compute when examining structures.

Problem Statement
You are a civil engineer and want to find the natural frequency of a structure you are designing. In order to determine this frequency it is necessary to use the quadratic equation to solve for the roots of:

$$A\,x^2 + Bx + C = 0$$

where: $A = 100 \quad B = -1.15 \times 10^4 \quad C = 2.7 \times 10^5$

$$\omega_n = \sqrt{x}$$

Hint: Use the quadratic formula. The C command **`sqrt()`** can be used to take the square root of a value and the **`pow`** function **`( pow(10,2) = 10² )`** can be used to evaluate exponents, but be sure to include the **`math.h`** library in your header. The two solutions, x, to the quadratic equation are real and positive. To determine the two natural frequencies, ω_n , take the square root of the x values.

Part 2)

Background
In aerospace engineering many experiments are performed in wind tunnels. When performing these experiments one important parameter is the rate at which air is flowing through the wind tunnel, known as the mass flow rate.

Problem Statement
You are an aerospace engineer and need to calculate the mass flow rate of air in kg/s through the wind tunnel. For a given set of conditions, the mass flow rate, $\dot{m}$, of air can be calculated by:

$$\dot{m} = \frac{D}{\sqrt{E}} + \sqrt{\frac{F}{G}\left(\frac{2}{2.4}\right)^{\frac{2.4}{0.4}}}$$

where: $D = 3.721\,x\,10^6 \qquad E = 295 \qquad F = 1.4 \qquad G = 287.04$

Instructions
Represent
- Refer to the algorithm below (and from **APP C11-1**).

Plan
- Create a file named **APP_C23_1.cpp**
- Outline the steps your program will take by adding comment statements to your file based on the algorithm and flowchart.

Implement

- Solve for the natural frequencies and mass flow rate in the program. Put Part #1 and Part #2 in the same program. Convert the **APP C11-1** assignment to the C programming language.
- Use well formatted **`printf`** statements to display your results.
- Compile, link, and run your program.

Evaluate

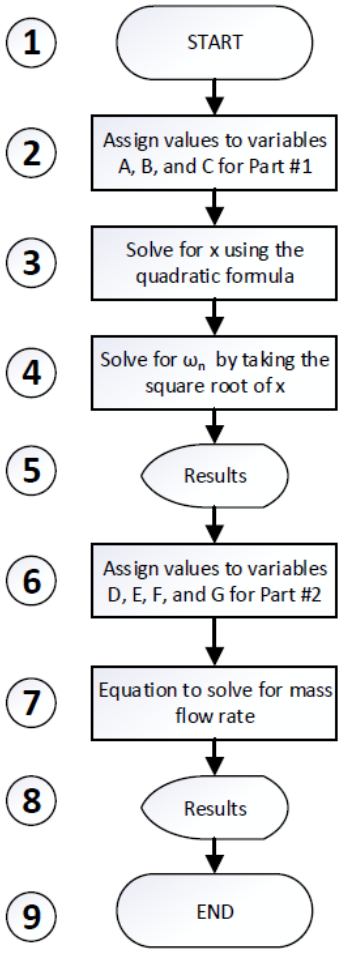
- Compare your results to that of the **APP C11-1** assignment to verify and check your results.

Document

- Create a single PDF that includes your code, any output, and your verification.
- Submit the PDF to Carmen according to the DAL

Algorithm

1. This section includes comments with the header information. See the sample header/comment section below. Also included are commands to print this information to the screen. Include this in your program.
2. Assign values to variables A, B, and C for Part #1.
3. Solve for x using the quadratic formula
4. Solve for ω_n by taking the square root of x.
5. Display natural frequencies to screen.
6. Assign values to variables D, E, F, and G for Part #2
7. Solve for $\dot{m}$ for Part #2.
8. Display mass flow rate to screen.
9. End



Sample Header Comments and Header to Write to Command Window

Include these in your file. Fill it out with your name, seat number, instructor/class, and the date.

```
/*********************************************/
/*  Name:  Brutus Buckeye   Date:  MM/DD/YY     */
/*  Seat:  00    File:  APP_C23-1.cpp           */
/*  Instructor:  ABC HH:MM                      */
/*********************************************/


printf ("*********************************************\n");
printf ("*  Name:  Brutus Buckeye   Date:  MM/DD/YY     *\n");
printf ("*  Seat:  00    File:  APP_C23-1.cpp           *\n");
printf ("*  Instructor:  ABC HH:MM                      *\n");
printf ("*********************************************\n\n");
```