ME 101 Assignment 7 Winter 2022

This assignment will be completed in partnership for both questions.

Deliverables

- **In this assignment, you will:**
  - Write and use functions in RobotC and C++

- **There are two deliverables for this assignment:**
  - **Question 1: RobotC**
  - **Question 2: C++**

Before you start programming

1. Sign out a robot with your partner
2. You may use your laptop with RobotC installed or the lab computer
3. Check the contents of robot kit to ensure all the parts are present. If not, please inform one of the teaching team members in the lab to record the missing part(s) and get replacement part(s) if the part(s) is needed for that assignment. Otherwise, when the teaching team members collect the robot kits at the end of the lab, the missing part(s) will be your responsibility to replace.
4. You are NOT allowed to take the robot apart. If you have questions about how the robot works, please consult the teaching team who is helping in the lab.

At the end of your Lab Session:

- Pack all the parts of the robot and store them in the robot kit.
- Bring the robot kit to the front for a teaching team member to check if all the parts are present and the robot is still in its proper standard lab configuration.

Question 1: Square Driving

What you need to do

The robot is going to drive in a square until it detects red. Robots will be placed on a square marked at the front of the lab near the door, where they will check for red, then drive forward 50 cm and turn 90 degrees, repeating these steps.

In a comment block, state:

- A least one assumption
- At least one potential problem with your solution that may cause it to fail (other than the motors or sensors failing, or poorly written code) that is relevant to the given problem

Your program should have functions:

- The `void rotateAngle(int angle, int motorPower)` function from the lecture
- A function `void configureSensors()` that configures the colour sensor and the gyro that you will write
- Another useful function, with at least one parameter, of your own design that helps solve the problem

Write a program that:

- Displays your group members' initials on line 5 of the display e.g. **CH RC**
- Waits for the user to push and release the Enter button
- Repeatedly:
    - Checks for red
    - Drives forward 50 cm
    - Turns 90 degrees
- The program ends when red is detected (use periodic polling to check after every turn)

The program should call the functions.

Demonstrating your program

You are required to demonstrate your working program to a member of the teaching staff. Once you have successfully downloaded and tested your program on a Lego robot, bring your robot to the front of the room. A TA will be available for you to demonstrate your robot's functionality.

What you need to submit

Submit your code to crowdmark. As the demonstration to the TA serves as output for your submission, you are only required to hand in your code for RobotC questions. No printed "output" section is required for RobotC questions in the assignment package.

Question 2: Paving and Fencing

Problem Description

A landscaping company has a crew of co-op students who do both paving and (sometimes) fencing. The company charges $ 19.50 for paving each square metre, or any part of a square metre, (i.e. 2.1 becomes 3 sq. m) and $27.00 per metre, or any part of a metre, for fencing. (Hint: There is a C++ function called **ceil** that rounds towards +∞.) All fences also have a $150.00 gate. Added to each bill is a $45.00 administration fee. HST is 13%.

The sales representative for the company has created a file called "**Sep_jobs.txt**" that contains the jobs completed by the work crew for the month of September. Each line of the file contains the following information:

- Job number
- Fencing Job? (indicating whether fencing has been done as well as paving)
- Shape (indicating the shape of the area paved/fenced)
- Dimensions (varying number of distances depending on the shape)

The shape names are all lower case:

Name in file	Actual Shape	Dimensions
tri	triangle	side1, side2, side3
quad	quadrilateral	side1, side2, diagonal, side3, side4

Typical lines of the file "**Sep_jobs.txt**" are:

```
7100 1 tri    30     40     50
7101 0 quad    3     3      4.24   3      3
7102 1 quad    28    28     39.60  28     28
:
:
```

Job number 7100 involves paving a triangle shape with sides 30 m, 40 m, and 50 m, 600 m^2 in area, and fencing around the edge of the triangle, 120 m long. Whereas for job 7101, no fencing was done, only paving, of a quadrilateral with sides 3m, 3m, diagonal 4.24 m, other sides 3 m, 3m, or 4.5 m^2 + 4.5 m^2 = 9 m^2 in area.

What you need to do

For this assignment you will break up the coding and for the functions each partner will write a portion of it. Decide who will be Partner A and who will be Partner B. We will use those designations below to indicate who writes what.

Write a program, including the functions described below, to do the calculations and produce a file with a nicely formatted table, as shown below.

```
Job# Fence PavedArea  PaveCost FenceLength FenceCost    Taxes  TotalCost
7100     1    600.00  11700.00      120.00   3390.00  1967.55   17102.55
7101     0      9.00    175.50        0.00      0.00    28.67     249.16
7102     1    784.00  15288.00      112.00   3174.00  2405.91   20912.91
:
:
```

You must write the following functions:

1. (Partner A) A function that receives three side lengths of a triangle and returns the perimeter.
2. (Partner B) A function which returns the area of a triangle. Use the following formula:
   Area = $\sqrt{semiperim * (semiperim - side1) * (semiperim - side2) * (semiperim - side3)}$
   where semiperim = perimeter/2, and side1, side2, and side3 are the side lengths.
   The function should call the triangle perimeter function.
3. (Partner B) A function which returns the perimeter of a quadrilateral
4. (Partner A) A function which returns the area of a quadrilateral.
   - This function must use the areaTri() function.
5. (Partner A & B) Another useful function that helps solve the problem

The main program is written by both partners.

What you need to submit

- Submit your code and the results of the output obtained from processing the input file "**Sep_jobs.txt**" in /*Block comment*/ at the end.