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This assignment will be **completed in pairs**.

Be sure to state any assumptions made for all questions.

At the start of the lab session you should sit at the desk with your assigned Lego Mindstorms kit.  Please do not alter or deconstruct the robot during/after the lab.
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In this assignment you will be using:
- Functions
- RobotC

Don't forget to include a signed header for your assignment, and to make sure that both students in the group have an electronic copy of the code when it is complete.


**Question 1 – RobotC**

a) Write a function that:
   - receives a number between 1 and 6 representing one of the available colours and a motor power
   - runs the robot forward at the above power until the given colour is detected
   - calculates and returns the speed the robot was travelling, in cm/s, over that interval using the **encoder(s)** to measure distance. The radius of the robot's wheel is 1.5cm.

b) Write a function that:
   - receives a number between 1 and 6 representing one of the available colours and a motor power
   - runs the robot forward at the above power until the given colour is detected
   - calculates and returns the speed the robot was travelling, in cm/s, over that interval using the **ultrasonic sensor** to measure distance

Write a program that:
- Displays the day and your group number on the display, e.g. Tues 07
- For 3 iterations, where the first iteration should stop on colour 2, and run at 40%, the second should stop on colour 3 and run at 60%, etc:
   - Waits for the user to press and release the orange button
   - Calls function (a), saves the individual returned speed, and displays it to the screen.
   - Waits for the user to press and release the orange button
   - Calls function (b), saves the individual returned speed, and displays it to the screen.
   - Calculates and displays the percent error in the ultrasonic sensor measurement. Assume that the encoder is more accurate. (Per error= 100*(U.S.-encoder)/encoder)
- Calculate and display the average percent error of the ultrasonic sensor speed

Demonstrate your program to a TA, print and submit your code **along with a copy (photo or hand-written) of all screen output from the running of the program.**

**Question 2 – C++**

A landscaping company has a crew of co-op students who do both paving and (sometimes) fencing. The company charges $18.50 for paving each square metre, or any part of a square metre, (i.e. 2.1 becomes 3 sq. m) and $26.00 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 $120.00 gate. Added to each bill is a $35.00 administration fee. HST is 13%.

The sales representative for the company has created a file called **"jobs.txt"** that contains the jobs completed by the work crew for the month of November (before it started snowing). Each line of the file contains the following information:

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

The shape names are all lower case:

| Actual Name | Shape | Dimensions |
|---|---|---|
| tri | Triangle | 3 sides |
| quad | quadrilateral | Side1, side2, diagonal, side3, side4 |
| sect | sector | Radius, angle in degrees |

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

```
7100  1    tri   30    40    50
7101  0    quad  3     3     4.24  3     3
7102  0    sect  3     30
...   ...  ...   ...   ...   ...   ...   ...
```

Write a program to do the calculations and produce a printout similar to the following:

```
Job # Actual Paved Area Pave Cost Actual F Length Fence Cost Taxes Total Cost

..          ..              ..          ..              ..       ..      ..
```

**For the following functions, evenly distribute them between Partner A and Partner B and clearly indicate which function was written by which partner.**

You must write the following functions:

1. A function which returns the area of a triangle.    Use the following formula:

   $A = \sqrt{s*(s-a)*(s-b)*(s-c)}$ , where $s = \dfrac{perim}{2}$ and $a$, $b$ and $c$ are the side lengths.

   Use the following function header:

   - `double areaTri (double S1, double S2, double S3)`

2. A function which returns the area of a quadrilateral.

   - This function must use the `areaTri()` function.

3. Perimeter and area functions for sectors, and perimeter functions for quadrilaterals and triangles.

4. Well-named function(s) to calculate and print costs

Code and test your program.  Submit your code with output for the file "`jobs.txt`".