Lab 07: The DS4 Equalizer

# Objectives:

* Practice top-down program design, problem-solving in C
* Practice writing functions to a specification
* Emphasize the importance of branching and looping structures
* Practice using output parameters

# Starting Point:

* [lab07.c](https://drive.google.com/open?id=12JJnTO4hTE2YoZEh4dPtn6v5c-bQoLMA)

# Turn-in:

* **Upload one .pdf file** containing the following before the start of lab next week

1. Include screenshots of code output in your lab report.
2. Turn in a lab report describing your experiences with this lab, along with   
    the answers to the questions at the bottom of this document.

* **Upload one .zip** file of your **lab07** folder. Title this **firstname\_lastname\_lab07.zip**. Before zipping, delete all generated **.exe** files (not the **ds4rd.exe**).

# Process:

## Problem

You are working on using the DualShock 4 as a data source for a game, but you are having trouble visualizing the readings from the DualShock 4 as a function of time. It would be nice to plot a bar graph in real time showing either the roll or pitch of the DualShock 4, but you realize that you are in a hurry and don't want to deal with getting the graphics code right. Suddenly, you realize that you can graph these variables as a horizontal bar chart using characters on the screen and then let the lines scroll down the screen to form a moving bar graph.

## Roll/Pitch

For our purposes, **roll** is defined as the angle the DualShock 4 is **tipped left or right while holding it normally**. **Pitch** is the angle from level that the DualShock 4 is **tipped forward or backward**.

In this lab, you will use skeleton code as your starting point to design and implement a modular DualShock 4 graphing application. Download the skeleton code lab07.c. You must use the skeleton code's function and basic structure to implement your program. **Carefully read the skeleton program before beginning. It may help you focus your strategy.** Take your time and carefully write and test individual functions in lab.

Because both roll and pitch may be positive or negative, you will need a bar graph where 0 is halfway across the screen at column 40. In the sample output below, if the value is 0 (or not enough to justify printing a character) output a 0 at column 40. If the value is greater than 0, output r's at column 40 and to the right. The number should be proportional to the value being graphed and such that pi/2 maps to 39 characters. Similarly, the L's should be used when the value is less than 0.

0

RRRR

RRR

R  
0

LLLLL

LLLLLLL

LLLLLLLLLLLLL

The above output would show a graph of 0, a slight positive trend of 3 positive readings, and 3 increasingly negative readings. When run, the program should graph roll. To switch to roll, the user should press the button. To switch to pitch, the user should press the X button.

## Joystick

Now that you have the button displaying roll and the X button displaying pitch, you can add in another source for getting the l’s and r’s. For example, instead of using roll and pitch from the gyroscope, you could use the joystick to generate the number of l’s, r’s, and 0 on the screen. For this problem, you only have to track one axis of the joystick, such as the left/right axis of the right joystick. This should be toggled with the O button.

To get the joystick data add the -j flag to the ./ds4rd.exe command line. Make sure you know what output and ordering is changed by adding this flag

(**BONUS:** Advanced option (5 points): toggle between roll, pitch and joystick with a single button. Holding down the button must not cause the modes to continue switching. This is optional and harder to do reliably than you might think.

(**BONUS:** Advanced option (5 points): For pitch modes, make your program print Fs and Bs (Forward and Back) instead of Ls and Rs. Harder than you may think.

**When you have your program working, have your undergraduate TA check off your source code and include a copy of it in your lab report.**

## Questions and Experiments

1. How did you scale your values? Write an equation and justify it.
2. As your experiment with the roll and pitch, what do you notice about the graph's behavior near the limits of its values?

## Notes:

* **You must write the functions that are given to you in the skeleton file.**
* **When trying to determine what how many Ls, Rs, Fs, or Bs, think about what their max and min values are, and what you have to do to get 39 of them to print either way.**

## Ending the Lab Session:

1. Be sure you will be able to have access to your code and data when you work on your lab report.
2. Leave your source code on your U: drive.
3. **Plug in the DS4 into its charging station!**
4. Log off before leaving your workstation in the lab!