

1. Description

The objective of this lab is to code, debug, and test the *putchar_lcd()* and *getkey()* functions. These functions are low level functions meant to interface with the MyRio's UART in order to display characters or perform escape sequences on the LCD or receive user inputs from the keypad. These functions are the means by which the higher level functions *printf_lcd()* and *fgets_keypad()* obtain and display user input. Below is a high level hierarchy for the main function and subsequent function calls; if statements and while/for loops are omitted for the sake of brevity.

Hierarchy:

```

Main
|_MyRio_Open()           // Opens a session with the MyRio
|_putchar_lcd()         // Prints passed character to the LCD screen
|   |_Uart_Open()        // Initializes the UART on first call of putchar_lcd()
|   |_Uart_Write()       // Passes data array to UART to display on screen
|   |_wait()             // Causes program execution to delay by about 0.5 seconds
|   |_printf_lcd()        // Prints passed character to the LCD screen
|   |_fgets_keypad()     // Captures keypad input by user and stores in a string
|   |_getkey()          // Detects and returns key pushed on keypad
|       |_Dio_ReadBit()  // Digital channel read function (also sets bit high)
|       |_Dio_WriteBit() // Digital channel write function, can set high or low
|       |_wait()         // Causes program execution to delay by about 0.5 seconds
|_MyRio_Close()          // Closes the session with the MyRio

```

Note 1: Some functions are called multiple times per hierarchy tier, but only one call is shown above.

Note 2: The bolded function names above indicate the functions of interest for this lab.

2. Testing

The *putchar_lcd()* function was first tested using direct calls in the *main()* function. These calls tested characters, escape sequences, and for values out of range (ex: *putchar_lcd(256)*). The *putchar_lcd()* function was also tested through indirect calls via *printf_lcd()*. The *getkey()* function was tested in a similar manner, with direct calls and indirect calls via *fgets_keypad()*. Not all of the tests were run at the same time and therefore some of the lines in the main function have been commented out.

3. Results

The *putchar_lcd()* function treated inputs as intended and properly displayed characters onto the LCD. One of the indirect calls through *printf_lcd()* used all of the prescribed escape sequences and the output was displayed as expected. The *getkey()* function's direct and indirect calls were also successful and the values returned by the function and subsequently printed to the LCD matched the value on the key pressed by the user. The only test result that was not as easy to determine was when a value passed into

the *putchar_lcd()* function was out of range. Nothing is (or should be) displayed on the LCD as EOF is returned from the function, but adding in a message to the console about an out-of-range value being passed to *putchar_lcd()* could improve testability in the future. Also, there are a number of escape sequences not addressed in the *putchar_lcd()* function that could add to it's functionality. For example, the horizontal tab (\t) and question mark (\?) are two that would have had immediate use in this and previous labs.