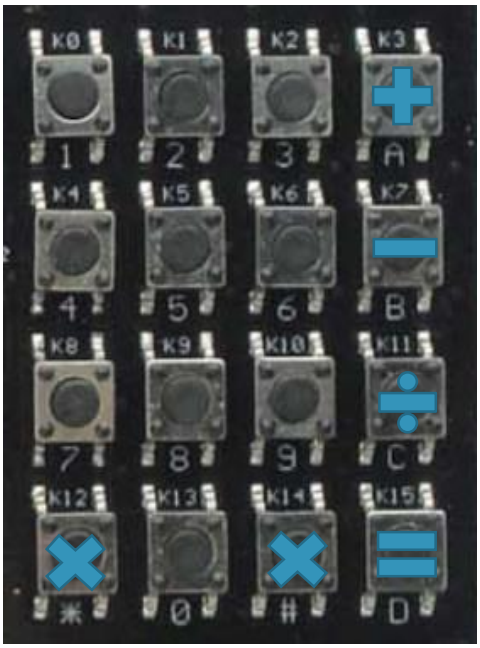
[LAB 5]
- GPIO “CALCULATOR” SIM -

CSE379 - Microprocessors



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NO MULTIPLICATION INCLUDED IN YOUR PURCHASE

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SECTION R3

UNIVERSITY AT BUFFALO

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Description

Division of Work

For the coding process, Dee and Carmen both worked on each subroutine and documentation together during lab sessions as a collective effort.

Purpose of the Program

In this lab, we approached a program that implemented user interface in which allowed the user to input a math expression similar to Lab3. However, the purpose of Lab 5 was to utilize interrupts while implementing the same logic except with implementations of the keypad as well.

When problems occurred throughout the lab, we took advantage of the use of debugging to check register values and making sure that inputted characters were being read. After each subroutine, we would exhaustively debug our program step by step to ensure that values were placed into the proper registers and converted properly.

Debugging Steps:

We experienced various issues during the lab. Most of the issues that occurred were mostly in the PORTA Handler where we dealt with the keypad readings.

1. The program would wait till it detected the keypad was pressed and then wait again in our read_from_keypad algorithm which caused a very slow process which didn’t allow more than one key to be displayed.
2. When handling the UART handler, the process would constantly loop. However, in the PORTA handler, we weren’t able to utilize the same process which didn’t allow us to retain our old information from each key causing our results to be very off.

How to use the program:

When the prompt is displayed, type in your desired expression in the following form:

a) Using keyboard: Integer, Operand, Second Integer. Afterwards, press Enter. Please note that this is without spaces.
b) Using keypad: Integer, Operand, Second Integer. Afterwards, press ‘D’ (the last button on the keypad). Please note that this is also without spaces.

Some outside resources used during the process of this lab involved the Generic User Guide for Cortex-M4 Devices and the provided ARM assembly reference card.

Logic

Main program:

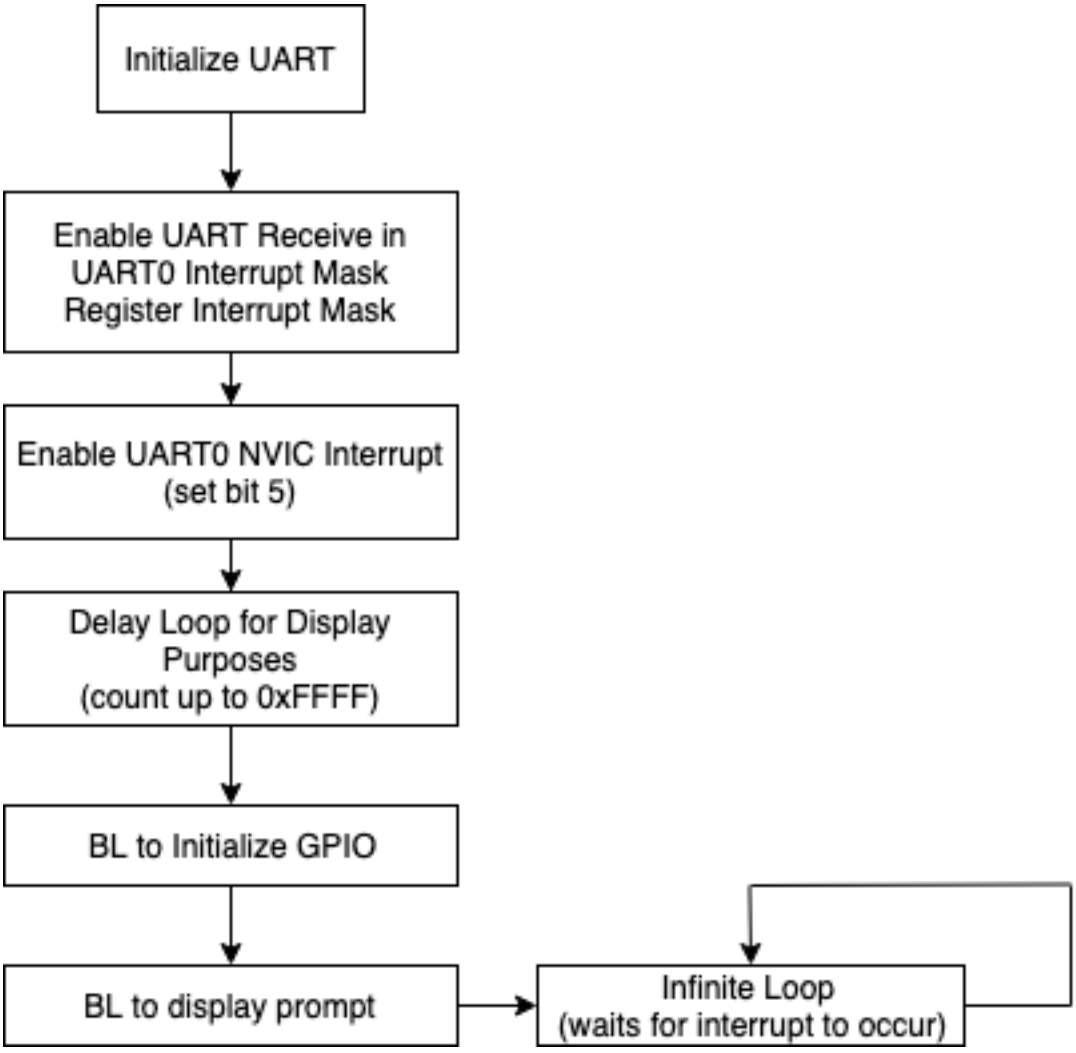
Prompt would be displayed for the user to input an expression in the form of integer, operand, and integer consecutively. Afterwards, depending on whether the use pressed a character from the keypad or keyboard, it will be directed to the respective interrupt handler. In each handler, it will read the typed/pressed expression and calculate accordingly after the user presses either ‘Enter’ on the keyboard or ‘D’ on the keypad.

Subroutines:

1. UART0Handler: Checks if user presses ‘q,’ if pressed, terminates the program. If the character is not ‘q,’ reads the expression that user enters and calculates it after the user presses ‘Enter.’ Then displays the remainder and clears the UART interrupt.
2. PortAHandler: Reads each character through the keypad and depicts the expression. After the user completes the expression and presses ‘D’ on the keypad (the past button on the keypad), the program will then calculate the expression and print out the answer and remainder. Clears PORTA interrupt and UART interrupt.

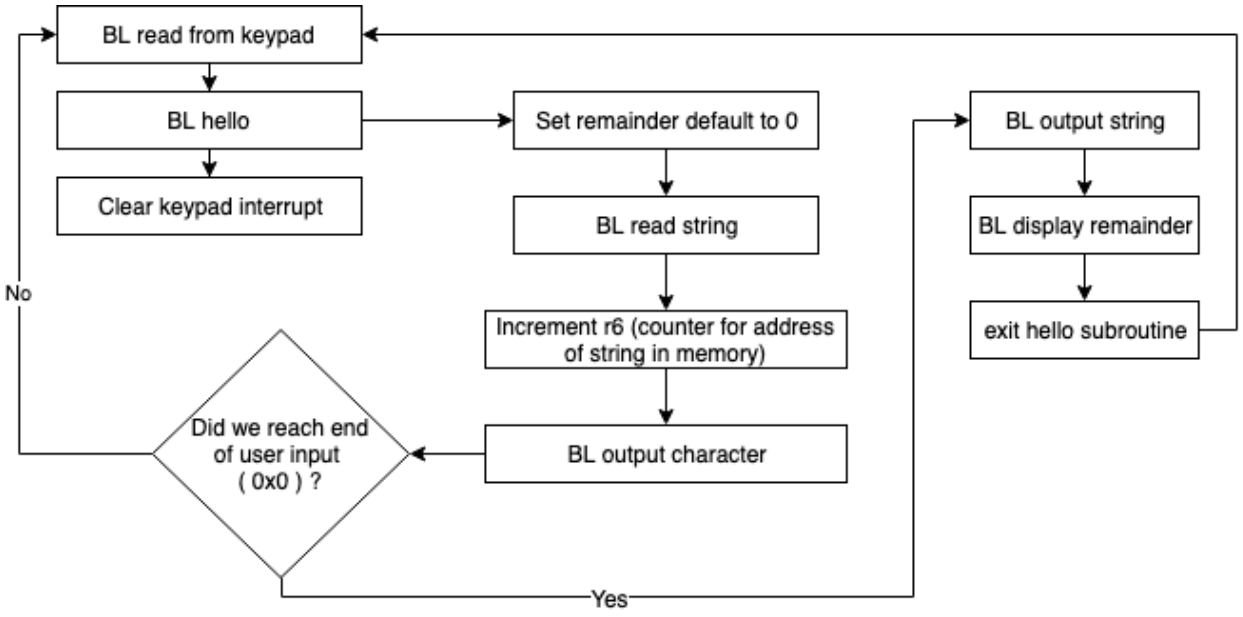
Main program flowchart

lab5:



Subroutine Flowcharts

PortAHandler:



UART0Handler: