University of British Columbia
Electrical and Computer Engineering
Digital Systems and Microcomputers
CPEN312

Lab 5 – Microcomputer Arithmetic

Introduction

For this laboratory assignment you write an assembly program to implement a 32-bit calculator using the CV-8052 soft processor and the 7-segment displays available in the DE0-CV board.

Components Required for this Module

For this assignment you will need an Altera DE0-CV board with the CV-8052 soft processor installed. Also you will need A51 and Crosside to compile and download your program to the processor.

Laboratory Assignment Requirements

1. Download, compile, and run the program *'Read_sw6.asm'*. This program reads SW0 to SW9 in the Altera DE0-CV board and displays the input number into the seven segment displays HEX0 to HEX5. For example, to enter the number 3478, toggle on and off the following switches: SW0, SW0, SW3, SW4, SW7, and SW8. The number 003478 will be displayed in the seven segment displays.

2. Write the assembly program for a calculator with the following operations: addition, subtraction, multiplication, division, remainder, and integer square root[1]. The calculator should work with unsigned 32-bit binary numbers, where both the input and output are in decimal. The numbers are input by toggling switches SW0 to SW9 on/off. Assume KEY3 is the 'function select' button, KEY2 is the 'Load Number' button, and KEY1 is the '=' button.

    This is the way the calculator should operate:

    Pressing/Releasing the 'Function Select' button selects the operation to execute. Display the selected operation using LEDR[5..0]:

    LEDR0 should be on when addition is selected.
    LEDR1 should be on when subtraction is selected.
    LEDR2 should be on when multiplication is selected.
    LEDR3 should be on when division is selected.
    LEDR4 should be on when remainder is selected. This is similar to the '%' C operator.

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[1] As defined here:
https://en.wikipedia.org/wiki/Integer_square_root

LEDR5 should be on when integer square root is selected.

Pressing/Releasing the 'Load Number" button saves the current displayed number and clears the display.

Pressing/Releasing the "=' button performs the operation selected with the saved number and the displayed number. The result of the operation is displayed using the 7-segment displays.

Display the number in decimal using the seven segment displays HEX0 to HEX5. To speed up the development of your program, a library of 32-bit arithmetic functions similar (if not identical!) to those studied in class is provide for you to use. You can find the file in the course web page under the name *'math32.asm'*. A program that demonstrates the use of the functions in *'math32.asm'* is also provided under the name *'math32test.asm'*.

Submit to Canvas a demonstration video or annotated pictures of your calculator working (include all operations) as well as your ASM source code. Your code must compile without errors or warnings.