ECE 2510

Lab 7

Objectives:

• Additional practice for loops/branches
• Practice inline assembly

In this lab, you will practice ARM loops and simple stack operations and watch the different registers/memory locations. In addition, you will practice finding the execution time of programs and creating delays using assembly and inline assembly.

Lab Tasks

Task 1

Write an ARM assembly code equivalent to the following C code. The variables should be stored in the stack. Simulate your program and screenshot the final value of the variables in memory. Find the number of cycles for your program in E-cycles. Pay attention to the size of each variable.

char
A,B,C; int
D; A = 2;
B = 6;
C= -10;
D= (A + B)*C

Task 2

Given the following program and the instruction reference manual, calculate the number of cycles it takes to execute and the execution time (Prelab). Enter the program into Code Warrior and
simulate it to verify your result. Take a screenshot of the final cycle count

AREA myData, DATA, READWRITE
i SPACE 4

AREA myCode, CODE, READONLY

```
EXPORT __main
ENTRY

__main
        MOV R0, #37
        LDR R1, =i
        STR R0, [R1]
Loop
        LDR R0, [R1]
        CMP R0, #0
        BEQ Done
        SUB R0, R0, #1
        STR R0, [R1]
        B Loop
Done
        B Done

END
```

Task 3

Use the delay assembly code from class (Execution Time) to generate a delay of 0.5 seconds. Note that you may need to use a loop inside a loop to achieve the total delay. Then download the C code we used in Lab 1. Using inline assembly, insert the delay sequence of instructions using asm{} in the main function where the delay (50000) function is called, i.e. replace the delay(50000); line with the inline assembly sequence. Note that you will not implement a function for the delay in this lab. Compile and download this to the board and confirm that the LEDs blink on and off correctly.

Answer the following questions:

1- How many cycles you will need to create a delay of 0.5 seconds (Prelab)?

2- How many iterations do you need to execute the loop on slide 5 to have a 0.5-second delay (Prelab)?

3- Does the answer for 2 fit in one ARM register? If not, what do you need to do to overcome the problem? (Prelab)

4- Were you able to get the exact same cycles in delay? Why or why not?

5- What is the total delay time that you were able to create?

Task 4

Write an ARM assembly program that calculates the area of a rectangle. Load the length and

width into registers R0 and R1 in your main code, then branch to a labeled block called Area that computes the result and stores it in global memory

Lab Reports are INDIVIDUAL

Include a well-commented code and add all components requested within each task description.

If your delay function does not accurately calculate the requested time. Find the error percentage and discuss the possible reasons for the inaccuracy.

Observe the delay function in the code and discuss how this function was formulated and how to verify its functioning; discuss as many techniques as you can find.

Provide the flowcharts for all the programs.