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Department of Electrical and Electronics Engineering

EEE316 Microprocessors

Spring 2020

Experiment III

Simulating I/O Ports and Math Operations

Pre-Lab Report

- Please study related topics in reference notes.
- Answer the questions under the lab activities. Prepare report in the specified format. Reports must be completed before coming to lab.
- Submit your report to CANVAS until March 11, 23:59.

Experimental Work

- Please explain your code step by step to instructors during lab hours.

Lab Objectives

- To examine the I/O port operation
- Improve math operations skills

References

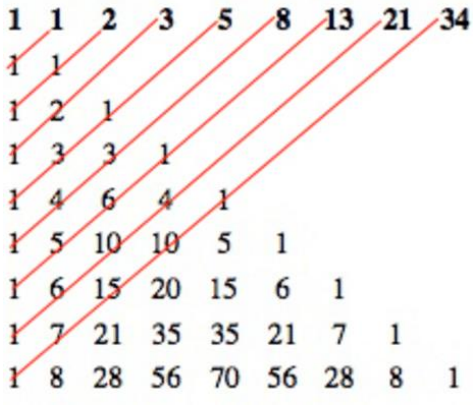
- Lecture notes
- Mazidi, McKinlay, Causey "PIC Microcontroller and Embedded Systems," Chapter 4 and Chapter 5

Lab Activities

1. **(MPLAB and PROTEUS)** Write and assemble a program to simulate Knight Rider LED scanner on each LED from pin 0 to 7 of PORTB and PORTC. You should drive each LED in a certain way so that the LED scanning will be like in video link (https://www.youtube.com/watch?v=osYhusGTGaw).
   You can see two LED boards. Consider left side as a PORTB and right side as a PORTC. You are expected to implement four different models as given in youtube video. Show and display the visual effect of turning the LEDs on/off in a softer way (looks like 2 LEDs are ON at the same time, pick your delay subroutine cleverly).

2. (MPLAB)

The Fibonacci sequence is one of the most famous formulas in mathematics.



The next number is found by adding up the two numbers before it. Assume the first element is 1. The second element is found by adding the two numbers before it, 1+0 = 1. The third element is found by adding the two numbers before it, 1+1 = 2. The fourth element is found by adding the two numbers before it, 1+2 = 3, etc.

Write and assemble a program that, find m^{th} Fibonacci number, where m is the given 1 byte number in the address labelled as INPUT and the result will be stored as 16-bit (2 bytes) in the address labelled as OUTPUT. Result should be in hex format.

Note :

a. Input will be entered as hex format. Max INPUT value (m) is 18H (24 Decimal)
b. During lab hours, INPUT will be entered via MPLAB program's File Registers section so you should write that your code with that in mind.

Example :

If INPUT m equals 14H (20 Decimal) then 20th number of fibonacci series is 6765. So the result (OUTPUT) is 6765 (Decimal) = 1A6DH

c. The address 0x00 should be label as INPUT, and 0x10 should be label as OUTPUT. Our result should be stored in 0x10 (High byte) - 0x11 (low byte) as 16 bits (2 bytes).

If input is 14H, 14H is stored as address 0x00. After execution, 1A6DH (OUTPUT) is stored as 16-bits in 0x10 and 0x11.

Address	Content
0x00 (input)	14
0x10	1A
0x11	6D

3. **(MPLAB)** Write and assemble a program to multiply two 16-bit signed numbers. Two inputs are taken from 0x00 and 0x02, respectively. The result is stored in address starts from 0x10. The inputs will be defined by the user. (Attention : If you implement unsigned multiplication, you will receive partial credits.)

You can see the algorithm for unsigned multiplication at below. Note that you are asked to implement signed multiplication which needs slight modification on unsigned multiplication algorithm.

```
      47 21
      5F 2A
      -----
      05 6A
   0B A6
   0C 3F
1A 59
------------
1A 70 EA 6A
```

```
      62 30
      43 2E
      -----
      08 A0
   11 9C
   0C 90
19 A6
-----------
19 C4 34 A0
```