EE 337: Interfacing to LCD Display Lab 4

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In this set of experiments, we develop display and other utilities which will be useful to us for the later experiments. For these experiments, you will have to attach the LCD unit to the Pt-51 board. Please remember that the display has to be plugged in such a way that it extends *outside* the board and *not* over it. Plugging in the display in the wrong orientation may damage it! Please refer to the attached tutorial on Liquid Crystal Display Control.

For this lab, you will need:

- the subroutine (bin_ascii.asm) which converts binary values to ASCII characters
- the subroutine (delay.asm) which can insert a delay of D/2 second
- the subroutine (readNibble) which will read binary values using slide switches
- the subroutine (lcd.asm) which writes characters to the LCD display (has been provided with this document)

Study them to see how they work. You can use them or write variations of them to be used in your programs yourself.

Note: For doing these exercises you can make use of any earlier written subroutines, as needed.

1 Homework

1. Using the supplied routine for writing characters to the LCD, Write a program that will display "EE 337 - Lab 2" on the first line and your name on the second line. Pad the display lines with spaces such that these are centered on the LCD when displayed. Your name should not be hard coded in the program, but stored as a 16 byte array of characters in the upper RAM. The program should display whatever is stored in this array. You should assemble, debug, download and run this program on the Pt-51 kit before coming to the lab.

2. Write a subroutine packNibbles. Two successive 4 bit values read using readNibble should be combined to form a byte (with most significant nibble being read first followed by least significant nibble), which should be stored at location 4FH.

2 Lab Work: Make your own debugger

1. Write a program which will display the contents of 8051 registers on the liquid crystal display in the following format:

First line of display should show the values of registers A, B and PSW in the format: "ABPSW = ?? ??", The second line should display the contents of R0, R1 and R2 in the format "R012 = ?? ??" Here ?? represents the actual content of those registers in Hex. This display should be held for about 5 seconds.

After this, the display should show "R345 = ?? ?? ??" on the first line and "R67SP = ?? ??" on the second line.

2. Write a program which will display the contents of memory location in the on-chip RAM. The location will be specified by setting switches on the board. (These are connected to the lower nibble of P1 on the Pt-51 board). The program should be interactive. The template is given below:

```
;First configure switches as input and LED's as output
; To configure port as Output clear it
; To configure port as input, set it.
;initialise LCD

loop:
;Display "Enter memory location" in the LCD
;wait for 5 sec
;Read 8 bit value using subroutine packNibbles
;Display the value of memory address and content in Hex on LCD
;eg: Display "12 53" where memory location 12H contains value 53H
;wait for 5 sec
;return to loop
```

Notice that you have to check whether the address range in question is in the directly addressable memory (00-7FH) or in the indirectly addressable memory (80-FFH). The

contents shown should have been fetched using the correct addressing mode.

The whole sequence should repeat endlessly. That is, read switches, display value, wait for 5 seconds, read switches, display value, wait for 5 seconds, read the switches again \dots and so on.