EE 337: Introduction to Timers
Lab 5

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This set of experiments has the following objectives:

- Familiarization with the timers in 8051
- Using timers to do simple tasks.

We can use built-in hardware timers in 8051 to generate delays without tying up the processor. Before attempting these exercises, please go through the notes on timers and interrupts uploaded to the moodle site.

This week, because of Quiz, you do not have any designated homework. However, we strongly encourage you to try some part of the following exercises so that your lab work will be done on time.

Lab Work

1. Write a subroutine which will use a 16 bit value stored at 81H/82H in the indirectly addressable memory to program the timer T0 in order to generate a delay proportional to this count.

   Recall that the 8051 counters count *up*. These generate an interrupt (if enabled to do so) when the count wraps around from 0FFFFH to 0000. If we want a timer to time out after n cycles, it should be loaded with -n (2's complement of n).

   So the subroutine should subtract the stored 16 bit number from 0000H and load the result as the initial count in T0.

   (While debugging the program with single stepping, you could initialize locations 81H/82H with 0001, which results in loading the timer with -1 = 0FFFFH so that it overflows at the first increment. In actual use, a different count will be stored, of course.)

2. We wish to implement a simple reaction timer that works as follows:

   (a) The program starts with a message on LCD as "PRESS SWITCH SW1" on the first line and "AS LED GLOWS" on the second line. After this display, command is given in program to turn on the LED(P1.4).

   (b) The user presses the switch(P1.0) because of the displayed message. The LED should be turned OFF as soon as the switch is pressed.

(c) The program is expected to measure time between the instant the LED starts glowing and the instant the switch press is identified.

(d) Then, the display on the LCD shows"REACTION TIME" on the first line and the " COUNT IS XXXXXX" on the second line. Thus, the time count in displayed on second line. (Assuming Timer0 is used, display of count should be of 6 digits: first 2 digits showing the number of times the timer has overflown, next 2 digits showing TH0 value, next 2 digits showing TL0 value). This message is displayed for 5 seconds. Then go back to Step 1, process should be repeated continuously.

The rough flow of the code would be:

```
ORG 0000H
LJMP MAIN

ORG 000BH ;ISR address for Timer 0
INC R0  ;To keep the count of no. of times timer as overflown
RETI

ORG 200H

MAIN :

      LCALL INIT
      BACK: LCALL DISPLAY_MSG1
                  LCALL START_TIMER
                  LCALL DISPLAY_MSG2
                  SJMP BACK

HERE: SJMP HERE
END

DISPLAY_MSG1:
- Displays initial msg

START_TIMER:
-Configures TMOD,(for 16 bit mode)
-Set IE correctly and actions on timer overflow should be
 written in Interrupt Service Routine address.
-Switches on LED
-Starts Timer (Set TR0)
-Wait for switch to go off.
-Clear TR0 to stop timer.

DISPLAY_MSG2 :
-Displays second msg

***(Note: When 8051 branches to interrupt vector it automatically clears TF flag )
```