EECE.3170: Microprocessor Systems Design I

Spring 2016

Lecture 26: Key Questions
April 6, 2016

1. (Review) Describe how to operate on multi-byte data.

Describe the operation of the given subroutine, which implements a 10 ms delay loop.

```
;*******************************************************************
; TenMs subroutine and its call inserts a delay of exactly ten milliseconds
; into the execution of code.
; It assumes a 4 MHz crystal clock. One instruction cycle = 4 * Tosc.
; TenMsH    equ  13       ; Initial value of TenMs Subroutine's counter
; TenMsL    equ  250
; COUNTH and COUNTL are two variables
TenMs
        nop                     ; one cycle
        movlw     TenMsH        ; Initialize COUNT
        movwf     COUNTH
        movlw     TenMsL
        movwf     COUNTL
Ten_1
        decfsz    COUNTL,F      ; Inner loop
        goto      Ten_1
        decfsz    COUNTH,F      ; Outer loop
        goto      Ten_1
        return
```

1. What factors determine amount of delay in loop?

2. What's downside of using loop for delay?

3. Under what conditions does function decrement COUNTH?

4. Under what conditions does function return?

5. How many times does each instruction in this function execute?

Describe the operation of the given subroutine, which toggles a series of 3 LEDs in sequence, assuming those LEDs are attached to bits 0-2 of Port D.

```
BlinkTable
        movf    PORTD, W        ; Copy present state of LEDs into W
        andlw   B'00000111'     ; and keep only LED bits
        addwf   PCL,F           ; Change PC with PCLATH and offset in W
        retlw   B'00000001'     ; (000 -> 001) reinitialize to green
        retlw   B'00000011'     ; (001 -> 010) green to yellow
        retlw   B'00000110'     ; (010 -> 100) yellow to red
        retlw   B'00000010'     ; (011 -> 001) reinitialize to green
        retlw   B'00000101'     ; (100 -> 001) red to green
        retlw   B'00000100'     ; (101 -> 001) reinitialize to green
        retlw   B'00000111'     ; (110 -> 001) reinitialize to green
        retlw   B'00000110'     ; (111 -> 001) reinitialize to green
```

In calling program

```
        call    BlinkTable  ; get bits to change into W
        xorwf   PORTD, F    ; toggle them  into PORTD
```

6. What do the first two instructions in this function do?

7. What does the addwf instruction do?

8. Why do we need 8 retlw instructions?

9. How is each return value used?

10. Why are upper 5 bits of every return value equal to 0?