EECE.3170: Microprocessor Systems Design I

Fall 2016

Lecture 25: Key Questions
November 9, 2016

1. Describe how to work with multi-byte data.

2. Translate these x86 operations to PIC code. Assume that there are registers defined for each x86 register (e.g. AL, AH, BL, BH, etc.). 16-bit values (e.g., AX) must be dealt with as individual bytes

- MOVZX AX, BL

- MOVSX AX, BL

- INC AX

- SUB BX, AX

- RCL AX, 5

3. 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
```

4. 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
```