EECE.3170: Microprocessor Systems Design I

Summer 2017

Lecture 11: Key Questions
June 14, 2017

1. Describe how to write PIC code to implement operations that deal with two registers (e.g. moving the contents of one register to another; adding two registers).

2. Describe how to implement conditional jumps.

3. Describe how to implement simple rotate operations and multi-bit shift/rotate operations.

4. Translate these x86 operations to PIC code. Assume that there are registers defined for each x86 register (e.g. AL, AH, BL, BH, etc.)
   - OR AL, BL
   - SUB BL, AL
   - JNZ label
   - JB label (B = below = unsigned less than)
   - ROL AL, 5

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

6. 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

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?