

16.317: Microprocessor Systems Design I

Fall 2014

Lecture 27: Key Questions

November 13, 2014

1. Describe the assembler directives that can be used in the MPLAB IDE.

2. Explain the operation of the following assembly program, which lights a single LED:

Start:

```
banksel    TRISC    ;select bank1
bcf        TRISC,0  ;make C0 an output
banksel    LATC     ;select bank2
clrf       LATC     ;initialize the
                ; LATCH by
                ; turning off
                ; everything
bsf        LATC,0   ;turn on LED C0 (DS1)
goto       $        ;sit here forever!
```

end

3. Explain the equivalent program in C, shown below:

```
void main(void) {  
    TRISCbits.TRISC0 = 0;    // Pin 0 = output  
    LATC = 0; //clear all pins to 0  
    LATCbits.LATC0 = 1; // turn ON LED  
    while(1) continue;  
}
```

4. Describe how to compile and run code in MPLAB. Explain the differences between running code in the simulator and on the development board. Also, discuss how to use the in-circuit debugger to access code on the chip as it runs.

5. Describe the following assembly program, which blinks a single LED:

```
cblock 0x70      ;shared memory accessible from all banks
Delay1          ;Two registers for delay loop in shared mem
Delay2
endc

ORG 0
Start:
    banksel      OSCCON      ;bank1
    movlw        b'00111000' ;set cpu speed of 500KHz
    movwf        OSCCON      ;OSCCON configures
                                ; internal clock
    bcf          TRISC,0      ;Pin C0 = output for DS1
    banksel      LATC         ;bank2
    clrf         LATC         ;Turn off all of the
LEDs
MainLoop:
    bsf          LATC, 0      ;turn on DS1

OndelayLoop:
    decfsz       Delay1,f     ;Waste time.
    bra          OndelayLoop  ;Inner loop takes 3 inst
                                ; per loop * 256 loops =
                                ; 768 instructions
    decfsz       Delay2,f     ;The outer loop takes an
                                ; additional 3
                                ; instructions per loop
                                ; * 256 loops
    bra          OndelayLoop  ;(768+3) * 256 = 197376
                                ; instructions /
                                ; 125K instructions per
                                ; second = 1.579 sec
    bcf          LATC,0        ;Turn off LED C0

OffDelayLoop:
    decfsz       Delay1,f     ;same delay as above
    bra          OffDelayLoop
    decfsz       Delay2,f
    bra          OffDelayLoop
    bra          MainLoop      ;Do it again...
end
```

6. Describe the equivalent program in C, shown below:

```
void main(void) {
    unsigned int delay; // 16 bit variable

    OSCCON = 0b00111000; //500KHz clock speed
    TRISCbits.TRISC0 = 0; //using pin as output
    delay = 11250;
    while (1) {
        //each instruction is 8us (1/(500KHz/4))
        while(delay-- != 0)continue;

        LATCbits.LATC0 ^= 1; //toggle LED
        delay = 11250; //reset delay counter
    }
}
```