EECE.3170: Microprocessor Systems Design I

Summer 2017

Lecture 12: Key Questions
June 15, 2017

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
```

1. Extra space to describe first program.

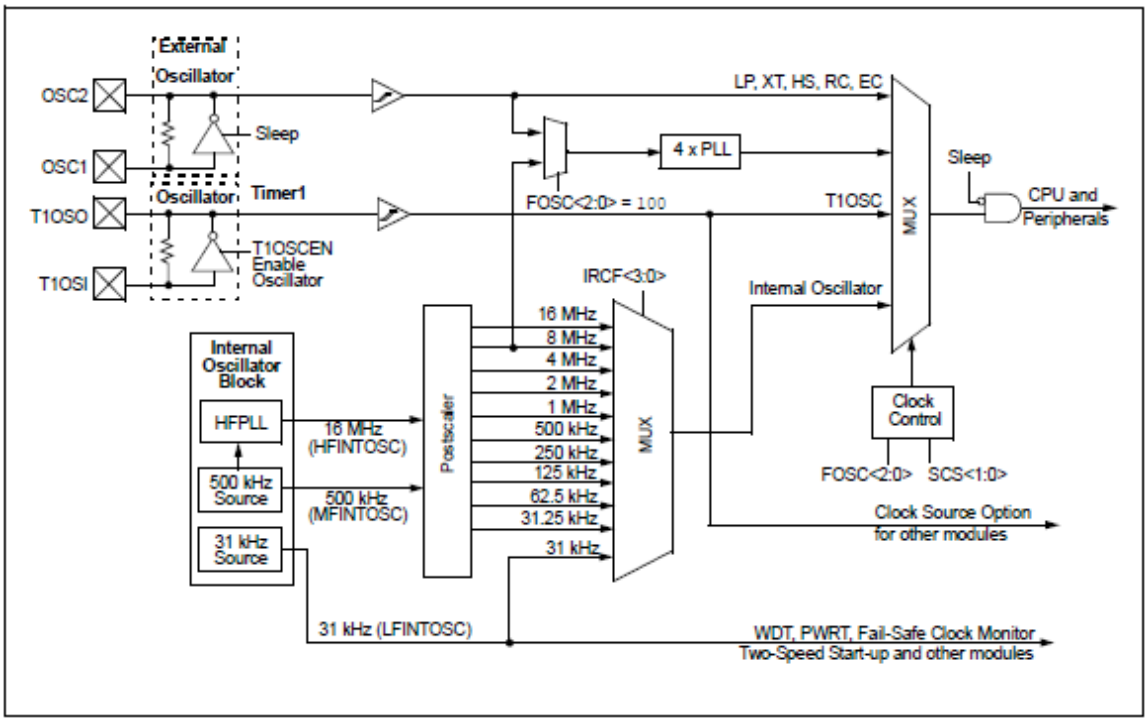
6. Describe the equivalent program in C, shown below:

```
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
    }
}
```

7. Describe the basic functionality of the PIC16F1829 clock generation module below:



8. Explain the operation of the programs used to rotate the LEDs using an instruction count-based delay loop (rotate.asm and rotate.c).

9. Explain the features of a typical microcontroller timer module.

10. Explain the operation of the programs used to rotate the LEDs using a timer-based delay loop (timer0.asm and timer0.c).