Microprocessor Principles and Applications
Final (Written Exam)
Jan. 6, 2021

1. (5%) In PIC18F, what is the internal clock and what is the external clock?

2. (a) (5%) What is the difference between unconditional I/O and conditional I/O?
   (b) (5%) What is the difference between polled I/O and interrupt I/O?

3. (5%) Use Timer0 in 16-bit mode. Assume an 8-MHz crystal, and a prescale value of 1:16. If you need to write a PIC18F assembly language program to obtain a time delay of 1 ms, what values should be set to TMR0H and TMR0L?

4. (5%) Suppose that there is a 10-bit A/D converter with $V_{REF-} = 2$ V and $V_{REF+} = 4$ V. Find the corresponding voltage values for the A/D conversion results of 40, 500, and 1000.

5. What is the main purpose of:
   (a) (5%) Capture mode
   (b) (5%) Compare mode
   (c) (5%) PWM mode.

6. (10%) Assume PIC18F4321 with Fosc = 1 MHz. Consider the following C program. What type of signal is generated on the RB4 pin? What is its frequency?

```
#include <p18f4321.h>
void    delay(void);
void    main(void){
            TRISBbits.TRISB=0;
            while (1){
                PORTBbits.RB4^=1;
                delay( );
            }
}
void    delay( ) {
            T0CON=0x01;
            TMR0H=0xc2;
            TMR0L=0xF7;
            T0CONbits.TMR0ON=1;
            while(INTCONbits.TM0IF = = 0)
                ;
            T0CONBits.TMR0ON = 0;
            INTCONbits.TMR0IF = 0;
}
```

Microprocessor Principles and Applications
Final Exam

Name:_____
ID:_____

Fall 2021

The exam is 120 minutes long. The total score is 101pts. Please read questions carefully.

1. (12 pts) Assume PIC18F4321. Suppose that three switches are connected to bits 0–2 of port C and an LED to bit 6 of port D. If the number of HIGH switches is even, turn the LED ON; otherwise, turn the LED OFF. Write a assembly language program to accomplish this using "if-else" construct. Assume that a '1' will turn the LED ON while a '0' will turn it OFF.

2. (15 pts) In PIC18F, what is the internal clock and what is the external clock? What is the main disadvantage of the internal oscillator?

3. (a) (8 pts) What is the difference between unconditional I/O and conditional I/O?
   (b) (8 pts) What is the difference between polled I/O and interrupt I/O?

4. (8 pts) Use Timer0 in 16-bit mode. Assume an 8-MHz crystal, and a prescale value of 1:16. If you need to write a PIC18F assembly language program to obtain a time delay of 1 ms, what values should be set to TMR0H and TMR0L?

5. (8 pts) Suppose that there is a 10-bit A/D converter with VREF- = 1 V and VREF+ = 4 V. Find the corresponding voltage values for the A/D conversion results of 40, 500, and 1000.

6. What is the main purpose the following modes. Explanation of how each of them works and the corresponding application should be provided.
   (a) (6 pts) Capture mode
   (b) (6 pts) Compare mode
   (c) (6 pts) PWM mode.

7. (12 pts) Write a C-program to generate a waveform with a 100 ms period and a 75% duty cycle on the CCP1 pin of the PIC18F4321. Use Compare mode, Timer3, and 1 MHz crystal.

8. (12 pts) Assume PIC18F4321. Write a C-program that will measure the period of a periodic pulse train on the CCP1 pin using the capture mode. The 16-bit result will be performed in terms of the number of internal (Fosc/4) clock cycles, and will be available in the TMR1H:TMR1L register pair. Use 1:1 prescale value for Timer1.