

Name _____

CM _____

Section _____

ME430 - Mechatronics
Examination I – Computer Portion
December 15, 2011

Problem	Score
6	/ 14
7	/ 9
8	/ 11
9	/ 26
Total	/ 60

For the computer portion of the exam, you may use only:

- Your computer
- Any paper notes (such as notes on the videos) you brought to the exam, so long as those notes were written by you or your lab partner.
- Any electronic notes or code residing on your local (C:) hard drive, so long as those notes/code were written by you or your lab partner.
- The course website. (This is the only approved use of the internet for this exam.)
- A calculator (optional).
- ANGEL for code submission.

Anything not specifically allowed is prohibited. In particular, you may not use notes or code written by someone outside your lab group.

Problem 6 (14 pts) – Printing

Suppose that we want to print the numbers 1 through 3 to the UART window using a for loop. We want each number on a separate line, and we want each number to appear in the window only once. Insert the appropriate lines of code into the template file below (don't worry about the comments):

```
/* *****  
 * Prints the numbers 1 through 3 to the UART window  
 * *****  
  
/** Header Files *****/  
#include <pl8f4520.h>  
  
  
/** Configuration Bits *****/  
#pragma config OSC = EC // EC = External 4MHz Crystal for PICDEM board only  
#pragma config WDT = OFF  
#pragma config LVP = OFF  
#pragma config BOREN = OFF  
#pragma config XINST = OFF  
  
/** Define Constants Here *****/  
#define SAMPLE 100  
  
/** Global Variables *****/  
int sampleVariable = 0;  
  
  
/* *****  
 * Function: void main(void)  
 * *****  
#pragma code  
void main (void)  
{  
    // This area happens once  
    // Good for initializing and things that need to happen once  
  
  
    while (1)  
    {  
        // This area loops forever  
  
  
    }  
}
```

Problem 7 (9 pts) – Using Special Function Registers

Specify the Special Function Registers (SFRs) in the code segment below according to the following specifications. Assume all other variables are appropriately defined before getting to `void main (void)`.

- Make five analog inputs. (Use the first five analog inputs.)
- Set pins RA4, RA6, and RA7 to be outputs and pins RA0 – RA3 and RA5 to be inputs
- Set pins RB0 – RB7 to be outputs.
- Set RA4 and RA7 high. Set RA6 low.

```
void main (void)
{
    ADCON1 = _____;

    TRISA = _____;

    TRISB = _____;

    PORTAbits._____ = _____;

    PORTAbits._____ = _____;

    PORTAbits._____ = _____;

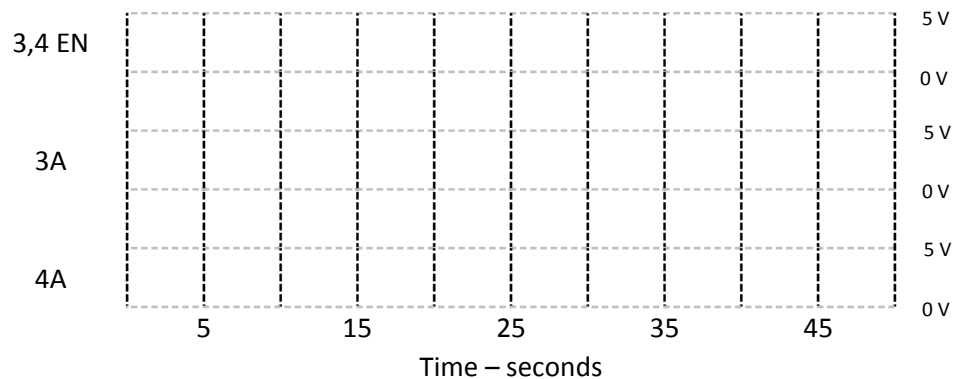
    PORTB = 0x00;

    idx = 1;
    result = 0;
    while( idx <= 5 ) {
        result = result + idx;
        printf("result = %d \n", result);
        PORTB = result;
        idx = idx + 1;
    }
    while(1) {
    }
}
```

Problem 8 (11 pts) – H-bridges

Sketch the enable signal and the two motor control input signals needed to drive a 24V bi-directional DC motor according to the specifications below. Use the grid provided for sketching your signals. Assume the DC motor is connected to the right-hand side of an h-bridge, which is the same as the one in your kits. The control sequence for the motor is:

1. Disabled for 5 seconds.
2. Enabled one direction for 5 seconds.
3. Disabled for 5 seconds.
4. Enabled in the opposite direction for 10 seconds.
5. Disabled for remaining time.



Problem 9 (26 pts) – Wiring

Connect the components shown below to accomplish the tasks on the list. **Note: you should not be adding any schematics to the figure—make your connections to the pictures of the components.**

1. Create a regulated 5V power line from the 6.3V supply. To keep your diagram neater, after you have created the regulated 5V power line use the symbol and label, Δ +5V, where it is needed. Similarly, use the standard ground symbol for necessary ground points. Assume all the grounds are interconnected.
2. Make the appropriate connections to the PIC for the
 - a. MCLR line (always held high)
 - b. ground(s)
 - c. power(s)
3. Create a basic switch and connect the signal line to RA1 on the PIC.
4. Make appropriate connections to allow the RB1 pin on the PIC to turn the magic box on and off. The magic box runs on 12V and draws 40 mA of current.

