Name _____ CM _____ Section _____

ME430 - Mechatronics

Examination I – Computer Portion

September 27, 2011

Problem	Score
5	/ 10
6	/ 20
7	/ 25
Total	/ 55

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 5 -- Fix this code:

Suppose that we have downloaded our standard template.c file, included <stdio.h> properly, and created the main routine shown below. Assume that `idx` and `result` are global `char` variables appropriately defined before the code below appears.

```
void main (void)
{
      ADCON1 = 0x0F;
      TRISB = 0x0C;
      PORTB = 0;

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

When we run this code, we want to set the Port B output pins to the binary representation of `result` and to print:

```
result = 1
result = 3
result = 6
result = 10
result = 15
```

However, in this code there are two syntax errors (code that will cause the program not to build), one programming logic error (code that will cause you to not get the output you want), and one hardware setup issue (code that will cause the hardware to not behave as you expect). Change the code so that it prints the five lines and sets Port B correctly, and clearly label the four errors in the code.

Problem 6 -- For loops and printing:

Starting from template.c, write a piece of code that *uses a for loop* to print out the numbers 27, 8, 1, -1, -8, and -27 using a formula (not hardcoding in those numbers). Print each value on a separate line. That is, the output of the code (to the Uart1 IO window) should be:

27
8
1
-1
-8
-27

For full credit on this problem, you must use the index of the for loop with an appropriate formula to accomplish this task (i.e. you can't just type in four different print statements).

Rename your template.c file to **problemXXX_yourName.c**

Put your finished code (just the *.c file) in the Angel dropbox.

Problem 7 – Wiring a stepper motor and PIC:

On the next page you will be drawing the connections necessary to drive a stepper motor with a PIC that someone else has programmed.

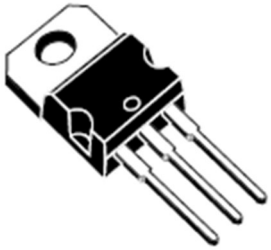
Assume that the PIC is programmed with the following code snippet:

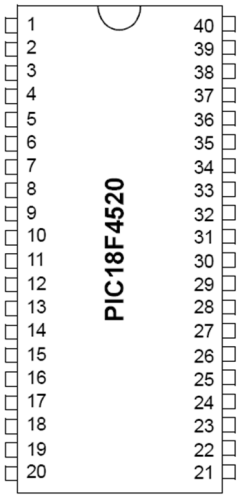
```
void CounterClockWise() {

//    BLACK = 1; BROWN = 0; ORANGE = 0; YELLOW = 1;
      PORTC = 0b00001001;
      DelayTime(HalfSecond);
//    BLACK = 0; BROWN = 1; ORANGE = 0; YELLOW = 1;
      PORTC = 0b00000101;
      DelayTime(HalfSecond);
//    BLACK = 0; BROWN = 1; ORANGE = 1; YELLOW = 0;
      PORTC = 0b00000110;
      DelayTime(HalfSecond);
//    BLACK = 1; BROWN = 0; ORANGE = 1; YELLOW = 0;
      PORTC = 0b00001010;
      DelayTime(HalfSecond);
}
```

Make sure to accomplish the following when you add your connections on the next page :

- Draw a 12 V power source and an unregulated 6 V power source. Hook up the voltage regulator chip to the 6V source to create a 5 V regulated line.
- Connect the H-bridge to the stepper motor as we did in lab.
- Connect the PIC and the H-bridge to power and ground. The motor should run at 12 V.
- Connect the PIC to H-bridge (a PIC pinout will be helpful).
- Add a pushbutton/basic switch circuit which is connected to the enable pin of the H-Bridge so that when the pushbutton is pressed the stepper motor stops.
- Add appropriate forms of inductive kick protection to the circuit, including snubber diodes and decoupling capacitors.
- Label all resistor and capacitor sizes. Use real resistor sizes from the E12 (10%) series.

You must connect to the physical devices already shown (i.e. don't ignore the pictures and just draw schematic symbols for them).

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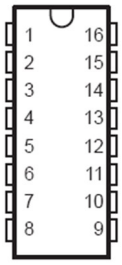
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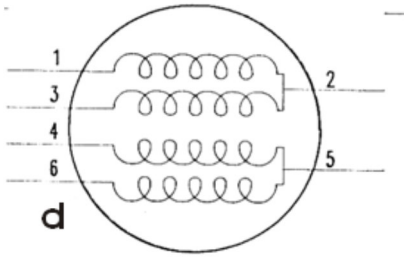
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