Name _____ CM _____ Section _____

Problem	Score
4	/ 9
5	/ 15
6	/ 15
7	/ 27
Total	/ 66

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 4 -- Fix this code:

Suppose that we have downloaded our standard template.c file, included <stdio.h> properly, and created the main routine shown below:

```
void main (void)
{
        bob = 1;
        while(bob<5)
                printf("bob = %d \n", bob);
                bob = bob + 1;
       }
        while(1) {
        }
}
```

When we run this code, we want to print:

bob = 1
bob = 2
bob = 3
bob = 4
bob = 5

However in this code there are two syntax errors (code that will cause the program not to build) and one logical error (code that will cause you to not get the output you want). Change the code so that it prints the five lines correctly and clearly label the two syntax errors and the logical error.

Problem 5 -- General Pin IO:

Starting from template.c, write a piece of code that would make the output value of RD3 be the opposite of the input value on RD2. The program should run continuously so that if the value of RD2 ever changes, RD3 also changes.

Make sure that you also:

- Set all pins as digital.
- SetRD2 and RD3 appropriately as inputs or outputs. Make all other pins on PORTD outputs.

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

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

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 2, 20, 200, and 2000 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:

2
20
200
2000

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 an 18V Solenoid and PIC:

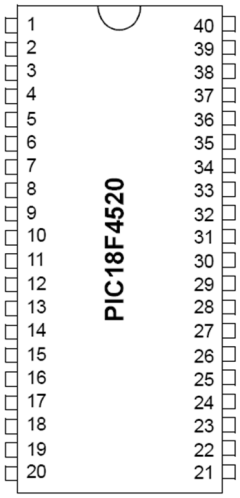
On the next page you will be drawing the connections necessary to drive a solenoid with a PIC.

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

Assume that the PIC is already programmed so that when RE0 goes low, then RC5 will go high and RC6 will go low. If RE0 is high then RC5 will go low and RC6 will go high.

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

- Draw an 18 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 a pushbutton, using a basic switch circuit, to RE0.
- Connect RC5 to pin 2 of the H-bridge and connect RC6 to pin 7 of the H-bridge.
- Connect the second pushbutton, using a basic switch circuit, to the H-Bridge enable line. When the pushbutton is not pressed, the H-bridge should be enabled. When the pushbutton is pressed the H-Bridge should become disabled.
- Connect the H-bridge to the solenoid (solenoid connections are very similar to the door lock motor used in lab).
- Connect the PIC to power and ground.
- Connect the H-bridge to power and ground. The solenoid should run at 18 V.
- Ground the enable line and ground pins on the unused side of the H-Bridge.
- Connect the MCLR line on the PIC appropriately.
- 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.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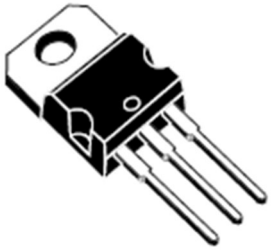

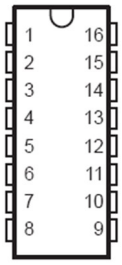
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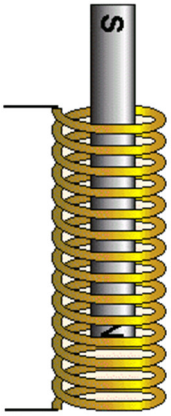
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