

Name _____

CM _____ Section _____

ME430 - Mechatronics
Examination I – Written Portion
September 27, 2011

Problem	Score
1	/ 15
2	/ 12
3	/ 15
4	/ 8
Total	/ 50

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

- 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.
- A pencil/pen.
- A calculator (optional).

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 1 – Variable types:

Convert the following hex numbers to Binary:

0x7C; 0x0A; 0x09; 0x7F; 0x36

To Decimal:

What is the 'smallest' variable type that will store one of these numbers?

Write a line of c code that stores the five numbers in an array using the least amount of memory.

Problem 2 – Operators

The following global variables have been defined

```
char a, b, c, d;
```

Based on these definitions, report the results (in decimal form) of the following operations. Show your work for full credit.

```
a = -7 * 20;
```

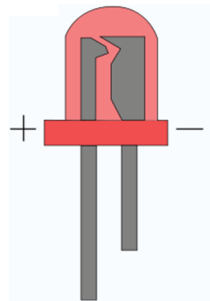
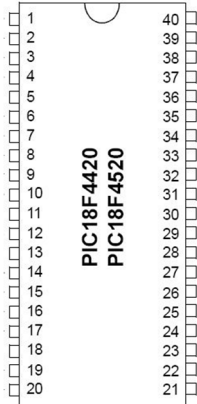
```
b = 32 % 9;
```

```
c = 35 | 13;
```

```
d = 13 << 3;
```

Problem 3 – Resistor sizing BJT (NPN) & LED:

Assume you have a 10 volt supply and we want to use that power supply to run an infrared LED (emitter) at 65 mA. The LED has a 1.4 volt forward voltage drop. We would like to use a PIC's RBO pin to drive an (NPN) BJT to run the LED.



On the diagram above:

- Draw in the circuit for the transistor running the LED using the 10 V power supply.
- Show the calculations to size any resistors that are needed for the circuit. Choose standard E12 series (10%) size resistors and label them on the diagram.
- Connect RBO on the PIC to the transistor circuit. You do NOT need to show other connections on the PIC (power, ground, etc.)
- Make connections to the physical devices shown, don't redraw a schematic symbol for a BJT or an LED.

Problem 4 – Clock Frequency and Instruction Cycles

Write the lines of code needed to set up the PIC internal oscillator to run at 125 kHz.

How long would it take to complete 78 instruction cycles using this clock?