

Name \_\_\_\_\_

Section \_\_\_\_\_

## **ME430 - Mechatronics Laboratory Exam**

January 29, 2008

Problem	Score
1 - Lights	/30
2 - Buzzer	/20
3 - LCD	/30
4 - Pushbutton	/10
5 - Code	/10
Total	/100

Put all four parts into the same .c file. When you are finished all four parts will be running at the same time. If you feel confident about your coding skills, you can finish all four parts and get them checked off together.

You can use your computer, the class website, any class notes,  
and any lab code written by your team.

You may **not** use your neighbor or **any work that was not done by you.**

You CAN ask for help from the instructor. This will come at a price!  
Each time you ask for help with a part, you will lose 5 points.

**ME430 Mechatronic Systems:  
Lab Exam: PIC programming on the PICDEM 2 Board**

**Part 1: Lights**

- \_\_\_\_\_ Part A) Lights RB3 and RB0 on
- \_\_\_\_\_ Part B) Lights toggling back and forth
- \_\_\_\_\_ Part C) Light toggling back and forth every 0.25 seconds

**Part 2: Buzzer**

- \_\_\_\_\_ Part A) Buzzer making noise at low frequency
- \_\_\_\_\_ Part B) Buzzer toggling from to low to high frequency every 0.25 seconds

**Part 3: LCD Counter**

- \_\_\_\_\_ Part A) Displaying a number on the LCD
- \_\_\_\_\_ Part B) Counting on the LCD screen
- \_\_\_\_\_ Part C) Counting in seconds on the LCD screen

**Part 4: Pushbutton Start/Stop**

- \_\_\_\_\_ Part A) Holding down RA4 stops program, release restarts program

**Part 5: Code submission**

Upload your code to Angel (only the .c file)

## **Part 1: Lights**

### **Part 1A) Lights RB3 and RB0 on**

Use the 4 LEDs on the PICDEM 2 board, make the LEDs RB3 and RB0 come on.

When you finish with this part you can have it checked off, or you can continue working on the problem. The program continues to build upon this part so checking off a later part counts as a check-off for all the earlier parts.

### **Part 1B) Lights toggling back and forth**

Make the LEDs toggle between Light State 1 and Light State 2:

	RB3	RB2	RB1	RB0
Light State 1	<b>On</b>	Off	Off	<b>On</b>
Light State 2	Off	<b>On</b>	<b>On</b>	Off

Each Light State can be displayed for any length of time that is visible to the human eye.

Again you can have this subpart checked off or continue working.

### **Part 1C) Light toggling back and forth every 0.25 seconds**

Make each Light State display on the LEDs for exactly 0.25 seconds. For the rest of this problem the lights should continue to use a 0.25 second delay.

When you have finished part 1C, you have finished all of part 1. The program continues to build upon this part so you can get it checked off along with later parts.

## **Part 2: Buzzer**

### **Part 2A) Buzzer making noise at low frequency**

Have the buzzer make a steady low frequency noise around say 500 Hz (calling 500 Hz a “low” frequency may be a stretch)

You can call over Dr. Fisher to check off this part or continue working on the part.

### **Part 2B) Buzzer toggling from to low to high frequency every 0.25 seconds**

At the same time when the lights switch have the buzzer change frequency. For example during Light state 1 play the 500 Hz buzzer noise. During Light state 2 play a higher frequency noise. Let's go with a nice annoying 800 Hz.

When you have finished part 2B, you have finished all of part 2. The program continues to build upon this part so you can get it checked off along with later parts.

Special Note: When you get the buzzer checked feel free to remove the little jumper above the piezo buzzer to stop it from annoying those around you. :). It's really annoying. Please put back the jumper when done with the test for next hour.

## **Part 3: LCD Counter**

### **Part 3A) Displaying a number on the LCD**

Display a number on the LCD screen.

### **Part 3B) Counting on the LCD screen**

Have the number on the LCD screen count up. Start at 0 and increase (let's say it should be able to count up to at least 50). Each number can be displayed for any length of time that is visible to the human eye.

### **Part 3C) Counting in seconds on the LCD screen**

Make the program count in seconds. So your program should always be showing the number of seconds it's been running.. Have the display read "Seconds = #" where # is number of seconds.

When you have finished part 3C, you have finished all of part 3. The program continues to build upon this part so you can get it checked off along with later parts.

## **Part 4: Pushbutton Start/Stop**

### **Part 4A) Holding down RA4 stops program, release restarts program**

For part 4A you need to use pushbutton RA4. When you press the button it should turn the lights out, stop the buzzer, and reset count to 0 (and display “ Seconds = 0 “on the LCD). When you release RA4 the program restarts and the count begins again from 0.

When you have finished part 4A, you have finished all of parts!  
Have your program checked off!

## **Part 5: Code submission**

### **Upload your code to Angel (only .c file)**

Go on Angel, under the Lessons tab, find the dropbox for your section and submit your file. You do not need to submit the LCD helper files. If you used multiple files like Supporting.c and Supporting.h, submit those (I'm guessing most people did not use helper files).

Make sure you add obvious things like your name and a brief description of what the program does before submitting the files.

Your commented title block and minimal comments within the project are important. You can also lose points for extremely inefficient or overly complex, brute force solutions. It is also possible to lose points for abundant worthless code that represents a lack of understanding. So if you copied code in from another lab make sure to remove things you don't need (like extra #include lines).

## **ME430 Mechatronics**

### **Prior to the Laboratory Exam**

The laboratory exam for this course will take place on January 29th. The laboratory exam will feel like a lab period, except you don't have a lab partner. You will be performing tasks on the PICDEM 2 board and calling over the instructor to check off completed work.

#### **Before coming into the Exam you should perform the following preparation tasks:**

- Create a workspace for the Lab Exam:
  - Use a template file to create the workspace
  - Setup everything needed for a workspace
    - Add the source file
    - Add the linker (18f4520i.lkr)
    - Make sure it builds

#### **During the lab exam you will be asked to do the following:**

Complete a series of tasks that make the PICDEM board perform the requested program. The problem will have multiple parts. For each part the program will get more complex. When you finish with a part you can have an instructor check it off, or you can continue working on the problem. The program continues to build upon earlier parts so checking off a later part counts as a check-off for the earlier parts.

#### **Code submission, good commenting practice**

At the end of the exam you will upload your code to Angel (only the .c file). You will go on Angel, under the Lessons tab, find the dropbox for your section, and submit your file.

Your code is worth 10 points and your score is based on two items, how well you follow good commenting practice and quality of your code solution. Quality of your code solution means it is possible to lose points for extremely inefficient or overly complex, brute force solutions. It is also possible to lose points for abundant extra information.

#### **Other test information**

You can use your computer, the class website, any class notes,  
and any lab code written by your team.

You may **not** use your neighbor or **any work that was not done by you.**

You CAN ask for help from the instructor. This will come at a price!  
Each time you ask for help with a part, you lose 5 points.