**EGR 425 Spring 2018  
Lab #2**  
**Due Fri Feb. 2, 2018 11:59PM**

1. In this lab, you will use serial communication to transfer bits from laptop and Arduino, and vice versa. You will use USART as described in the lecture.
2. Go to Blackboard and download lab2.c. A template file is provided.
3. For this lab, you will build on top of lab1. So don’t disassemble what you had for lab1. Make sure you have the LEDs connected to digital pins 8 through 13 (six in total).
4. Now find the buzzer (black and round component with 2 leads). Flip it around, and you will see + and – sign. Connect the **+ lead to Digital Pin #7** and connect the **– lead to ground**. This completes our hardware setup.
5. Read lab2.c and implement the following functions based on the lecture:
   1. void USART\_init(void);
   2. char USART\_receive(void);
   3. void USART\_send(char data);
   4. void USART\_send\_string(char string[]);
6. In **PART 1** of your main function, you are to do the following:
   1. You should be able to type some keys on the keyboard and send that character to the microcontroller over serial.
   2. Since we have 6 LEDs, create a switch statement with 6 character mappings. After a character has been received by the microcontroller, use USART\_send\_string() to display which character was received. Then play a note using playNote().
      1. For example, if you press ‘a’ on the keyboard, this should be received by the microcontroller, and the microcontroller needs to send a string to the computer to display ‘a’ was pressed. Then play the A note.
      2. Also light up the LED. Each key should be mapped to a different LED. So if you press ‘a’, only LED #1 is lit up (for example). If you press ‘e’, only LED #3 is lit up and nothing else.
7. In **PART 2**, add a case for the special character ‘z’ in your main function’s switch statement. When this key is pressed, play an actual song or tune. As the song is playing, the LEDs should light up in any pattern you like.
8. Once you are ready for testing, follow this instruction to run your program to work with serial communication. Open your command prompt and **make flash** to upload lab2 program to the microcontroller. Then type this into the command prompt:

**python -m serial.tools.miniterm --eol CR COM4 9600**

to bring up a serial terminal emulator on COM4 port (or whichever port you are connected to). This terminal allows you to send data to the connected device and also read what the device sends through serial.

1. Now, you can send a character to laptop and receive a character from laptop through serial communication. And as you type one of the 6 keys you have as switch statement cases, your buzzer should play some sound. You can experiment with the different notes by referring to the provided file **scale16.h**. And with a sequence of key presses, you can play music.
2. Once you got the hang of the music notes, create a sequence of notes to play that lasts a few seconds. Again, make it so that when the user presses ‘**z**’, your sequence of notes is played. Example video: <https://www.youtube.com/watch?v=Bv8hzpH54GE>
3. Final step of this lab – Once you have some music playing, add some logic to blink the LEDs as well (in any pattern you like). See the video above for one way of blinking the LEDs.

**Lab2 Deliverables – Turn in ONE per group**

1. Upload lab2.c (Upload one per group to Blackboard)