CSCE 236 Embedded Systems, Spring 2013
Homework 2

Started: Thursday, January 17, 2013
Due: Beginning of class Thursday, January 24, 2013

Instructions: This homework is an individual assignment, collaboration is not allowed. If you discuss any problems with others, please note this on the assignment as described in the syllabus. Also note any materials outside of lecture notes, course textbooks, and datasheets that you used. Show your work and describe your reasoning to get partial credit if your solution is incorrect. This homework is due on the date listed above before the start of class.

Name:

Problem 1 (5pts). *(To be completed at end of assignment) Approximately how much time did the total assignment take? Which problem took longest and how much time did it take?*

Problem 2. *Arduino Setup and Programming (*Note you only need the Arduino for this assignment, you will not need the breadboard or any of the other components.*)*
Instructor sign off: *Before the start of class on the due date, you must show the instructor or TA the functional code running on your Arduino for this part of the assignment (you can get both parts signed off at the same time). You can get signed off at any of the office hours of the instructor or TAs (see online for posted times).* **Plan ahead** *and email the instructor or TA to make alternative arrangements if none of these times work, but do not leave this until the last moment. Failing to get signed off before the due date will result in a zero for the programming portion of this assignment.*
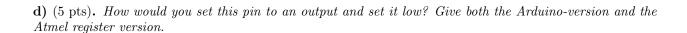**You must also turn in your code by visiting** `http://cse.unl.edu/~cse236/handin/.` *Failing to electronically turn in your code will result in a 10 point penalty on this assignment. Points may also be deducted for coding errors, poor style, or poor commenting.* Note, you do not need to turn in a printout of your code for this assignment.

a) (10pts). *For this problem, you should configure the Arduino programming software on your computer. Then program your Arduino with the sample Blink program. Once you have verified that you can compile and program your board with this sample program, modify it so that it blinks a long-short-long pattern of blinks 5 times with a pause between each blink pattern. Use a loop, do not just copy and paste code. (make sure to read through the following questions before starting as knowing the answers will help you).*
Sign off:

b) (15pts). *For this problem, you should write a program that will monitor the keyboard from the* **Serial Monitor** *(located in the tools menu) and will turn on the LED if you press the 'l' key, off if you press the 'o' key, and will blink the number of times that the LED has been toggled (turned from off to on) when the 'b' key is pressed. To get started with this, look at the example code (the communication section is a good place to start) that comes with the Arduino sketch environment and their online help. Do not make the code any more complex than it needs to be (e.g. do not use serialEvent()), but also remember that there should be appropriate comments in your code.*
Sign off:

c) (5pts)**.** *How did you specify the version of the Arduino you are using in the Arduino programming environment?*

d) (5pts)**.** *How did you specify the serial port the Arduino is connected to in the software? What is the port name on your computer?*

e) (5pts)**.** *What voltage does the main processor on the Arduino run at? If it draws 10mA, what is the power usage in Watts?*

Problem 3. *Digital I/O. Refer to the Arduino Uno R3 schematic posted on the course website for this question. For these questions, make sure to give* `C` *code where appropriate.*

a) (5 pts)**.** *On the Arduino, how would you configure pin* `7` *on the output headers to be an input and how would determine if the pin is set* `HIGH`*? For this question, use the Arduino commands.*

b) (5 pts)**.** *Which pin on the Atmel does this pin correspond to?*

c) (5 pts)**.** *Which* registers *(there are two) control this pin and how would you set this pin to an input and determine if it is set to high? By register, I mean those you find in the datasheet (e.g.* `PORTB`*).*

d) (5 pts). *How would you set this pin to an output and set it low? Give both the Arduino-version and the Atmel register version.*

Problem 4. *Resistors*

a) (5pts). *In the schematic above, what is the voltage at points A, B, and C?*

b) (5pts). *How much current is flowing through each of the resistors?*

c) (5pts). *What is the equivalent series resistance of all of these resistors? What is the equivalent resistance if they were all placed in parallel instead?*

Problem 5. *ATmega328 Datasheet*

a) (5pts)**.** *What memory address is the* `DDRB` *register located at?*

b) (5pts)**.** *How would you set (give the* `C` *code) bits 3 and 4 in the* `DDRB` *register to the lowest two bits in the variable* `var`*? Make sure you set these bits at the same time and do so in a single line of code.*

c) (5pts)**.** *Which assembly instructions take the most clock cycles to complete? How many clock cycles do they take?*

d) (5pts)**.** *What is the end memory address for the Internal SRAM on the Atmel on the Arduino??*

Do not forget to fill in the amount of time you spent on this assignment in Question 1.