ENGI 4862
Microprocessors

Assignment 5

Due Wednesday, 02 August 2017, 4:00 PM

1 ADC Programming [20]

ATmega32 PA0 is connected to a sensor so that the voltage input can be converted to digital by channel 0 (i.e., ADC0) of the AVR ADC. By using the polling method, the digital result should be read and displayed on PortD and PortC (PortD for high byte and PortC for low byte) continuously. Use AVCC as Vref, left-justified result bits, Fosc/32 as the ADC clock where Fosc is the speed of the crystal frequency connected to the AVR chip. Program to implement the task above.

2 C Programming [30]

For this question, you must submit your C program for part (a) as well as a copy-and-paste/screen capture of the disassembly from part (b) along with your comments.

(a) In AVR Studio, write a program in C (by choosing AVR-GCC rather than AVR-Assembler when setting up the project) that:

   (a) configures port A as input and port B as output (to LEDs, initially off),

   (b) reads in port A bit 5 and if it is 1, increments a counter (that starts from 0),

   (c) delays for 1000 loop iterations,

   (d) then goes back to step 2 and reads A.5 again.

When the count exceeds 10000, it should turn on all the LEDs of port B and halt the program. [15 marks]

(b) Compile and simulate the program from part (a), then view the disassembly window. Comment on how the compiler converted your code into assembly, with a focus on parts that were different than you would have though, and parts that were as expected. Include a copy of the disassembly with your submission. [15 marks]

3 Interrupt Programming [50]

This question involves writing interrupt code. Specifically, you must write a program that:

- Configures Timer0 to use its output compare match interrupt to trigger when it reaches 100.

- Configures Timer1 to use its overflow interrupt.

- Configures external interrupt INT1 to be a falling-edge interrupt.

- Enters a main loop where you increment a counter, outputs the lower 5 bits of the register to the lower 5 bits of Port C (connected to LEDs), then enters a 200-cycle delay loop before increment the counter again.

- When Timer0's interrupt is triggered, its ISR should toggle port C.5.

- When Timer1's interrupt is triggered, its ISR should toggle port C.6.

- When INT1 is triggered, it should toggle C.7.

Submit your well-commented code.