Embedded Real-Time Systems (AME 3623)
Homework 4

April 10, 2008

This homework assignment is due on Tuesday, April 15th at 5:00pm. Your work may be handed in electronically (use the Homework 4 digital dropbox on D2L) or in hardcopy form (in person or to my office).

This assignment must be done individually: do not share/discuss your answers with others or look at the answers of others.

Question 1

1. (10pts) Briefly explain why polling can be undesirable when performing input/output operations.

2. (10pts) Define an Interrupt Service Routine.
Question 2

1. (15pts) Suppose we want a function – called `donow()` – to be executed once every 21s. What is the timer1 prescaler configuration and the (pseudo)code for the interrupt routine (the code does not need to be syntactically correct)?
Consider the following code.

```c
volatile uint8_t duration;

ISR(TIMERO_OVF_vect) {
    static uint8_t counter = 0;
    ++counter;
    if (counter >= duration) {
        donow();
        counter = 0;
    }
};
```

Somewhere in the main program:

```c
// Interrupt occurs every
// (64*256)/16000000 = 1.024 ms
timer0_config(TIMER0_PRE_64);
// Enable the timer interrupt
timer0_enable();
// Enable global interrupts
sei();

while(1)
{
    <change the value of duration>
}
```
2. (5 pts) What does the ISR do?

3. (5 pts) What does the main program do (in the while() loop)?

4. (5 pts) Does a shared data problem exist between the ISR and the main program?
Question 3

(20pts) Below is the FSM for the vending machine that we discussed in class.

![Vending Machine FSM Diagram]

Alter this vending machine such that if three nickels are inserted (starting from state $0), then a dime is returned immediately and the vending machine still maintains a state of $.15.

Question 4

How much time did you spend on this assignment?