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.

```
volatile uint8_t duration;

ISR(TIMER0_OVF_vect) {
   static uint8_t counter = 0;

   ++counter;
   if(counter >= duration) {
    donow();
    counter = 0;
  };
};

Somewhere in the main program:

// 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>
}
```

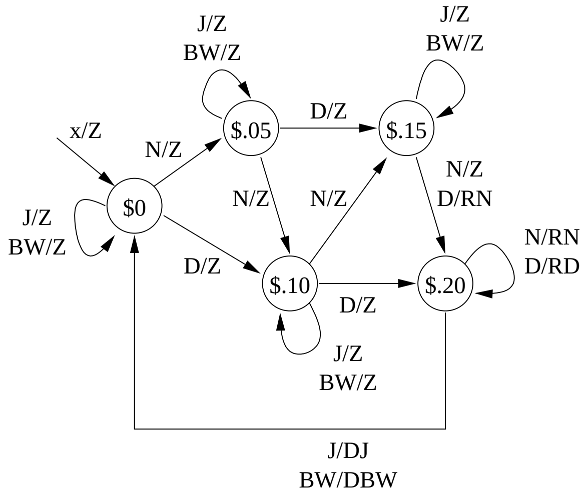
2. (5 pts) What does the ISR do?

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.



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?