Embedded Real-Time Systems (AME 3623)
Homework 4

April 15, 2009

This homework assignment is due on Tuesday, April 28th 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) Briefly outline what the microprocessor does in response to an interrupt.
Question 2

Suppose we want to produce a regular interrupt frequency of approximately 30.49 Hz. Assume that we are using a 16 MHz crystal for our clock.

1. (5 pts) Which timer should we use?

2. (5 pts) Which prescaler should we use?


Question 3

Suppose we want to produce a regular interrupt every 512 $\mu$s. Assume that we are using a 16 MHz crystal for our clock.

1. (5 pts) Which timer should we use?

2. (5 pts) Which prescaler should we use?

Question 4

1. (15 pts) Suppose we want a function – called `donow()` – to be executed once every 0.79s. Assume a system clock of 16MHz. What is the timer1 prescaler configuration and the (pseudo)code for the interrupt routine (the code does not need to be syntactically correct)? Also - show the code in your main function that configures the timer.
**Question 5**

Consider the following code.

```c
volatile uint8_t duration;

ISR(TIMERO_OVF_vect) {
    static uint8_t counter = 0;

    ++counter;
    if (counter == 0) {
        donow1();
    }
    if (duration == counter) {
        donow2();
    }
};
```

Somewhere in the main program:

```c
// Interrupt occurs every
// (256*256)/16000000 = 4.096 ms
timer0_config(TIMER0_PRE_256);
// Enable the timer interrupt
timer0_enable();
// Enable global interrupts
sei();

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

2. (5 pts) What does the main program do (in the while() loop)?

Question 6
How much time did you spend on this assignment?