EE 308 – Homework 7

Due March 7, 2005

For all problems below assume your are using a MCS12DP256 chip with a 24 MHz bus clock and a 4 MHz oscillator clock.

1. What setup do you need to do to have the HC12 generate an interrupt on the rising edge of Input Capture 3? Write some C code to do this.

2. An engineer is using the HC12 to determine the speed of a motor in RPM. A pulse is generated on Bit 1 of `PORTT` 16 times every revolution of the motor. Bit 1 of `PORTT` is set up for input capture mode, and captures the time of the rising edge. The prescaler bits PR2:0 are set to 010. It is known that the time between pulses is less than the timer overflow time. When the first edge is captured, the TC1 register has a value of 0xF87A. When the second rising edge is captured, the TC1 register has a value of 0x0DB4.

   (a) What it the length of time between the two rising edges?

   (b) How long does it take the motor to make one revolution?

   (c) What is the motor speed in RPM?

3. What setup do you need to do to have the HC12 toggle bit 3 of `PORTT` on a successful output compare? Write some C code to do this.

4. You want to generate a 250 Hz square wave using Output Compare 3. What value should you add to TC3 in your `toc3_isr()`? (Assume that the prescaler bits PR2:0 = 101.) What else should you do in your `toc3_isr()`? Write the interrupt service routine `toc3_isr()` to do this.

5. Write a C program to that generates a 20 ms delay after an external event (rising edge) happens. Set up Bit 1 of `PORTT` for input capture of a rising edge, and Bit 2 of `PORTT` for Output Compare. The HC12 waits for a rising edge on Bit 1 of `PORTT`. It then generates a rising edge on Bit 2 of `PORTT` exactly 20 ms after the rising edge is detected on Bit 1. Bit 2 is left high for exactly 20 ms, then is brought low.

6. Write a C program which uses Bit 4 of PORTT to generate the following signal: The signal consists of five pulses which are high for 100 μs and low for 100 μs, followed by a 1000 μs low signal. (See Figure 2 of Lab 7. This signal then repeats. NOTE: the long low signal is 1100 μs (not 1000 μs).