For all problems below assume you 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 0xDB4.

   (a) What is 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).