EE 308 – Homework 7

Due March 3, 2006

For all problems below assume your are using a MCS12DP256 chip with a 24 MHz bus clock and a 8 MHz oscillator clock.

1. Write a program to do the following: Set up bits 0, 1, 2 and 3 of Port T to capture the time of a rising edge. Use interrupts to do this. In the main program loop, wait until all four inputs have captured an edge, then print the time of edges using the DBug-12 `printf()` routine.

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 0xC5A6. When the second rising edge is captured, the TC1 register has a value of 0x2794.

   (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 set bit 3 of `PORTT` to a high 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 that generates a 40 ms delay after an external event (rising edge) happens. Set up Bit 4 of `PORTT` for input capture of a rising edge, and Bit 5 of `PORTT` for Output Compare. The HC12 waits for a rising edge on Bit 4 of `PORTT`. It then generates a rising edge on Bit 5 of `PORTT` exactly 40 ms after the rising edge is detected on Bit 4. Bit 5 is left high for exactly 40 ms, then is brought low.

6. You are given the task to design a remote control using a 9S12 microcontroller. The POWER button is supposed to generate a signal with the following characteristics: high for 100 ms, low for 50 ms, high for 100 ms, low for 25 ms. This signal is repeated as long as the POWER button is pressed. The POWER button is connected to Bit 0 of PORTT. The output is connected to Bit 2 of PORTT. Write a C program which will generate the desired signal signal. A rising edge from the POWER button should generate an interrupt, which will initiate the desired signal on the output. A falling edge from the POWER button terminate the output signal. Write your program using interrupts.