

ECE 3724/CS 3124 Quiz #9 – Timers Quiz, Fall 04 Solution - Reese

- a. Assuming a oscillator frequency of 12 MHz, configure Timer 2 and the PWM module to produce a square wave with frequency of 3 KHz (just give prescale, PR2 values – I do not want C-code). Choose the prescaler such that the PR2 value is greater than 10.
- b.

Timer2 PWM period = $(PR2+1) * (4/FOSC) * PRE$ (POST is NOT used for PWM period)
 $(1/3 \text{ KHz}) = (PR2+1) * (4/12 \text{ MHz}) * PRE$
 $PR2 = [(12 \text{ MHz}/4) / (3 \text{ KHz} * PRE)] - 1 = (1000/PRE) - 1$
For PRE = 1, PR2 = 999 (> 255, too large)
For PRE = 4, PR2 = 249, will work
For PRE = 16, PR2 = 61.5, so either 61 or 62 will work.

- c. Assuming TIMER2 is configured for PWM mode, with a value of 0xC8 for the PR2 value. What value for the upper 8 bits would need to be written to the duty cycle register (CCPR1L) to give a duty cycle of 20%?

For 20% duty cycle, $CCPR1 = 0.2 * 0xC8 = 0.2 * 200 \sim 40$

- d. Assume Timer2 is configured to produce an interrupt period of X for postscale = 4, prescale = 4, and PR2 = 0xC0. If PR2 is changed to 0x20, postscale changed to 15, and prescale changed to 1, how does the new interrupt period Y relate to the old interrupt period of X?

Old $((PR2+1) * PRE * POST) /$ New $((PR2+1) * PRE * POST) / = ???$
 $((0xC0+1) * 4 * 4) / ((0x20+1) * 1 * 15) = (193 * 16) / (33 * 15) = 6.2$. The old interrupt period is 6.2x longer than the new interrupt period, or the new interrupt period is 16% of the old interrupt period.

- e. Write C code that configures timer1 for a prescale of 8, internal clock, 16-bit read/write mode, turns it on, enables its interrupts, and enables capture mode for every falling edge.

```
// initialize timer 1
// prescale by 8
T1CKPS1 = 1; T1CKPS0 = 1;
T1OSCEN = 0; // disable the oscillator
TMR1CS = 0; //use internal clock
T1SYNC = 0; // sync extern clock
RD16 = 1; // 16 bit r/w to timer1
TMR1ON = 1;
CCP1CON = 0x04; // every falling edge
CCP1IF = 0; CCP1IE = 1; IPEN = 0, PEIE = 1; GIE = 1; // enable interrupts
```

- f. What is the longest possible period of the Timer1 interrupt using an FOSC = 10 MHz? Give the answer in milliseconds.

Timer1 Clock period is $1/(10/4 \text{ MHz}) = 4.0e-7 \text{ seconds} = .4 \mu\text{s}$.
Using largest prescale of 8, rollover is $0.4 \mu\text{s} * 8 * 2^{16} = 209,715.2 \mu\text{s} \sim 210 \text{ ms}$