Homework 10

**1. If the input clock source operates at 16 MHz, what is the TCNT1 value needed to generate a time delay of 0.5 millisecond in normal mode?**

0.5ms = 8000 cycles (16 MHz)

65536 – 8000 = 57536

TCNT1 = 0xE0C0

**2. If the clock operates at 10 MHz, what is the OCR0 value needed to generate time delay of 4 microseconds in CTC mode without any prescaler.**

4 microseconds = 40 cycles (10 MHz)

40 -1 = 39

OCR0 = 0x27

**3. Write an assembly program for Timer1 to generate a square wave of 16000 Hz to output on PB3 using a clock frequency of 16 MHz.**

# period of 16000Hz is 1000 cycles (at 16Mhz)

# toggle every 500 cycles

.set TIMER1\_INIT\_VAL = (0x10000-500)

ldi r19, 0b00001000

ldi r20, 0b00000000

sbi DDRB, 3 ; set PB3 to output

out PORTB, r20

# initiate timer

ldi r18, hi8(TIMER1\_INIT\_VAL)

sts TCNT1H, r18

ldi r18, lo8(TIMER1\_INIT\_VAL)

sts TCNT1L, r18

ldi r18, 0

sts TCCR1A, r18

ldi r18, 1

sts TCCR1B, r18

# Wait for overflow

wait: in r18 TIFR1

sbrs r18, TOV0

rjmp wait

# toggle PB3

ldi r18, (1<<TOV0)

out TIFR1, r18 ; clear overflow flag

eor r20, r19

out PORTB, r20

rjmp wait

**4. What is the advantage of using falling/rising edges instead of high/low voltages to detect events?**

The rising/falling edges of a signal occur where the signal changes, in comparison to the high/low voltage which represents the current state of the signal. Because you want to respond to changes in a signal, you want to detect the rising/falling edge.

**5. What is the signal the following code generates at PORTB pin 5? If it is a periodical signal, what is its period? The clock frequency is 16MHz.**

toggles PB5 every 197 cycles

period: 394

Period: 24.625 microseconds