EEN 3449
Lab 8 Siren Generation **Fall 2009**

A) Write a program to generate a two-tone siren continuously that oscillates between 200 Hz for 0.5 second, no oscillation for 0.5 second, 1000 Hz. for 0.5 second and no oscillation for 0.5 second. Use the buzzer on your MiniDragonPlus to output the two-tone siren. Demo to your TA.

- Set the prescale factor for TCNT to 8.
- The delay count for the low frequency tone is (24,000,000 ÷ 8) ÷ 200 ÷ 2 = 7,500.
- The delay count for the high frequency tone is (24,000,000 ÷ 8) ÷ 1000 ÷ 2 = 1,500.

```
#include "d:\MiniDragon\examples\reg9s12.h"

hi_freq   equ   1500            ; delay count for 1000 Hz
lo_freq   equ   7500            ; delay count for 200 Hz
toggle    equ   $04             ; value to toggle the TC5 pin, $04=%0000 0100
          org   $1000
delay     ds.w  1               ; store the delay for output-compare operation

          org   $1500
          lds   #$1500          ; load $1500 to stack pointer
; initialize the interrupt vector entry
          movw  #OC5_isr,UserTimerCh5   ; initialize the interrupt vector entry
          movb  #$90,TSCR1      ; enable TCNT, fast timer flag clear
          movb  #$03,TSCR2      ; set main timer prescaler to 8

          bset  TIOS,OC5        ; enable OC5
          movb  #toggle,TCTL1   ; select toggle for OC5 pin action, OM5:OL5 = 0 1
          movw  #hi_freq,delay  ; use high frequency delay count first
          ldd   TCNT            ; start the high frequency sound
          addd  delay           ;   "
          std   TC5             ; copy Reg D to TC register for channel 5
          bset  TIE,OC5         ; enable OC5 in Timer Interrupt Enable Register
          cli                   ;   "

forever   ldy   #50             ; wait for half a second (50 x 10 ms = 0.5 s)
          jsr   delay10ms       ;   "
          movw  #lo_freq,delay  ; switch to low frequency delay count
          ldy   #50             ; wait for half a second
          jsr   delay10ms       ;   "
          movw  #hi_freq,delay  ; switch to high frequency delay count
          bra   forever

OC5_isr   ldd   TC5
          addd  delay
          std   TC5
```

```
          rti

; The following subroutine creates a time delay that is equal to [Y] times 10 ms.

Delay10ms pshd                  ; save accumulator D
          bset    TIOS,OC0      ; enable OC0
          ldd     TCNT
again1    addd    #30000        ; start an output-compare operation
          std     TC0
          brclr   TFLG1,C0F,*
          ldd     TC0
          dbne    y,again1
          bclr    TIOS,OC0      ; disable OC0
          puld                  ; restore accumulator D
          rts
          end
```

Registers related to the Output-compare Function

	7	6	5	4	3	2	1	0	
$0040	IOS7	IOS6	IOS5	IOS4	IOS3	IOS2	IOS1	IOS0	TIOS
$0043	Bit 7	6	5	4	3	2	1	Bit 0	TCNT(L)
$0044	Bit 15	14	13	12	11	10	9	Bit 8	TCNT(H)
$0046	TEN	TSWAI	TSFRZ	TFFCA	0	0	0	0	TSCR1
$0048	OM7	OL7	OM6	OL6	OM5	OL5	OM4	OL4	TCTL1
$0049	OM3	OL3	OM2	OL2	OM1	OL1	OM0	OL0	TCTL2
$004C	C7I	C6I	C5I	C4I	C3I	C2I	C1I	C0I	TIE
$004D	TOI	0	0	0	TCRE	PR2	PR1	PR0	TSCR2
$004E	C7F	C6F	C5F	C4F	C3F	C2F	C1F	C0F	TFLG1
$0051	Bit 7	6	5	4	3	2	1	Bit 0	TC0(L)
$0052	Bit 15	14	13	12	11	10	9	Bit 8	TC0(H)
$005A	Bit 7	6	5	4	3	2	1	Bit 0	TC5(L)
$005B	Bit 15	14	13	12	11	10	9	Bit 8	TC5(H)

```
TIOS:    Timer Input-capture/Output-Compare Select Register
TCTL1:   Timer Control Register 1 (p.342 of the text)
TCTL2:   Timer Control Register 2
TIE:     Timer Interrupt Enable Register
TSCR1:   Timer System Control Register 1
TSCR2:   Timer System Control Register 2
TFLAG1:  Timer Interrupt Flag 1 Register
TCNT:    Timer Counter Register
TC5:     TC register for Channel 5

OMn      OLn      :     output level
 0        0            no action (timer disconnected from output pin)
 0        1            toggle PTn pin
 1        0            clear PTn pin to 0
 1        1            set PTn pin to 1
```

B) Modify your program to generate a two-tone siren continuously that oscillates between 200 Hz for 0.5 second, no oscillation for 0.5 second, 1000 Hz. for **1 second** and no oscillation for 0.5 second. Use the buzzer on your MiniDragonPlus to output the two-tone siren. Demo to your TA.

Note:

The period for a 200 Hz signal = $\frac{1}{200} = 0.005\,\text{sec}$, and half of that period = $\frac{1}{200} \times \frac{1}{2} = 0.0025\,\text{sec}$

With a prescale factor = 8, the MCLK is scaled down from 24 MHz to 3 MHz.

Thus the period of each clock cycle = $\frac{1}{3MHz} = \frac{10^{-6}}{3}\,\text{sec}$

The delay count for 0.0025 sec = $\frac{0.0025}{\frac{10^{-6}}{3}} = \frac{0.0025 \times 3}{10^{-6}} = 7,500$

The period for a 1000 Hz signal = $\frac{1}{1000} = 10^{-3}\,\text{sec}$, and half of that period = $\frac{1}{1000} \times \frac{1}{2} = 5 \times 10^{-4}\,\text{sec}$

With a prescale factor = 8, the MCLK is scaled down from 24 MHz to 3 MHz.

Thus the period of each clock cycle = $\frac{1}{3MHz} = \frac{10^{-6}}{3}\,\text{sec}$

The delay count for 0.0025 sec = $\frac{5 \times 10^{-4}}{\frac{10^{6}}{3}} = \frac{5 \times 10^{-4} \times 3}{10^{-6}} = 1,500$