```
;*****************************************
;interrupt_generates_square_wave_vary_duty_cycle.asm
;*****************************************
        PROCESSOR PIC16F628
        #include <P16F628.INC>
        __CONFIG    _CP_OFF & _MCLRE_OFF & _HS_OSC & _LVP_OFF & _WDT_OFF

        cblock  0x20
            temp
            temp1
            count
            count0
            count1
            count2
            w_temp
            OPTION_REG_temp
            STATUS_temp
        endc
        ORG 0x00        ;reset vector
        goto main

        ORG 0x04        ;interrupt vector
        goto TMR0_ISR       ;exit Interrupt Service Routine

;---push pop---
        PUSH    MACRO
        movwf   w_temp      ;   w_temp = w
        swapf   w_temp,f    ;   swap them, ใช้ swap เพราะ movf มีโอกาสที่จะไปเปลี่ยน zero
        flag ใน status register
        banksel TRISA       ;   select bank1
        swapf   OPTION_REG,w;   w= OPTION_REG
        movwf   OPTION_REG_temp;OPTION_REG_temp= w
        banksel PORTA       ;   select bank0
        swapf   STATUS,W    ;   w= STATUS
        MOVWF   STATUS_temp ;   STATUS_temp= w
        ENDM
        ;PUSH uses 8uS

        POP MACRO
        SWAPF   STATUS_temp,w
        MOVWF   STATUS
        banksel TRISA       ;   select bank1
        swapf   OPTION_REG_temp,w
        movwf   OPTION_REG
        banksel PORTA       ;   select bank0
        swapf   w_temp,w
        ENDM
        ;POP uses 7uS
        ;push+pop = 15uS
;---end push pop---

main:
        call init
foreground_task:
        nop
        nop
        nop
        goto foreground_task

;---interrupt---
;clock 4MHz, 1cycle=1uS
;generates square wave, T=200uS, f=5KHz, duty 75%
;on 150uS -> 150 cycle -> TMR0 Rate 1:1 ->  Timer0 = 256-150 = 106
;off 50uS -> 50 cycle -> TMR0 Rate 1:1 -> Timer0 = 256-50 = 206

;if T=400uS, 2.5KHz -> need 1:2 prescaler, duty 75%
;on 300uS -> 300 cycle -> TMR0 Rate 1:2 ->  Timer0 = 256-(300/2) = 106
;off 100uS -> 300 cycle ->TMR0 Rate 1:2 -> Timer0 = 256-(100/2)= 206
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```
68  ;movlw B'0000 0000'
69  ;movwf OPTION_REG
70
71  ;exam may change clock frequency
72  ;clock 8MHz, 1cycle=0.5uS
73  ;generates square wave, T=200uS, f=5KHz, duty 75%
74  ;on 150uS -> 300 cycle -> TMR0 Rate 1:1 ->  Timer0 = 256-300 = can't, need
    prescaler 1:2
75  ;off 50uS -> 100 cycle -> TMR0 Rate 1:1 -> Timer0 = 256-100 = 156
76
77  ;if T=200uS, 5KHz -> 1:2 prescaler, duty 75%
78  ;on 150 -> 300 cycle -> TMR0 Rate 1:2 ->  Timer0 = 256-(300/2) = 106
79  ;off 50uS -> 100 cycle ->TMR0 Rate 1:2 -> Timer0 = 256-(100/2)= 206
80  ;movlw B'0000 0000'
81  ;movwf OPTION_REG
82
83
84  TMR0_ISR:
85          PUSH                    ; 8 cycles
86          bcf     INTCON,T0IF     ; clear Timer0 interrupt flag
87  ;--------toggle long code for any% duty only-----------------
88          btfss   PORTB,7
89          goto    set_hi
90  set_low:bcf     PORTB,7
91          movlw   .206            ;
92          movwf   TMR0            ; off period
93          goto    set_done
94  set_hi: bsf     PORTB,7
95          movlw   .106            ;
96          movwf   TMR0            ; on period
97  set_done:
98  ;--------end toggle long code for any% duty only-----------------
99          POP                     ; 7 cycles
100         RETFIE
101 ;---end interrupt---
102
103
104
105 init:
106         ;---Port Config---
107         ;CMCON is not necessary if PORTA isn't used
108         banksel TRISB       ; select Bank1
109         bcf     TRISB,7     ; Port RB0 is an output pin (bcf=0=output,
            bsf=1=input)
110         banksel PORTB       ; select Bank0
111         ;---End Port Config---
112         ;---Interrupt Config---
113         bsf     INTCON,T0IE ; enable timer0 interrupt
114         bcf     INTCON,T0IF ; clear timer0 interrupt flag
115         movlw   .106        ; on period
116         movwf   TMR0        ; set TMR0 = 156
117         bsf     INTCON,GIE  ; enable global interrupt *enable GIE should be
            the last code line (dunno why)
118         ;---End Interrupt Config---
119         ;---Option Config---
120         banksel OPTION_REG
121         movlw   B'00001000' ; TMR0 Rate 1:1
122         ;movlw  B'00000000' ; TMR0 Rate 1:2
123         ;movlw  B'00000001' ; TMR0 Rate 1:4
124         ;movlw  B'00000010' ; TMR0 Rate 1:8
125         ;movlw  B'00000011' ; TMR0 Rate 1:16
126         ;movlw  B'00000100' ; TMR0 Rate 1:32
127         ;movlw  B'00000101' ; TMR0 Rate 1:64
128         ;movlw  B'00000110' ; TMR0 Rate 1:128
129         ;movlw  B'00000111' ; TMR0 Rate 1:256
130         movwf   OPTION_REG
131         banksel PORTB
132         ;---End Option Config---
```

```
133             clrf    PORTB
134             return
135
136             END
137
```