

1. With reference to the following subroutine to create a 10 ms delay

```

delay10ms movb    #$90 ,TSCR1           ; enable TCNT and fast flags clear
          movb    #$06 ,TSCR2           ; configure prescale factor to 64
          movb    #$01 ,TIOS           ; enable OC0
          ldd     TCNT
          addd    #3750                 ; start an output compare operation
          std     TC0                  ; with 10 ms time delay
wait_lp2  brclr   TFLG1,$01,wait_lp2   ; if equal, C0F in TFLG1 is set to 1
          rts
    
```

Determine the missing parameters in the following table:

Note: 1 MHz = 10⁶ Hz, and 1 ms = 10⁻³ s.

	E Clock	Delay Time	Prescale factor	# of counts	Channel
a	24 MHz	25 ms	128	4,687.5	OC1
b	24 MHz	40 ms	64	15,000	OC2
c	24 MHz	45 ms	32	33,750	OC3
d	24 MHz	50 ms	64	18,750	OC4

- a) Clock frequency = 24 MHz / 128 Period for each E clock = 128 / 24 μs
 # of counts for 25 ms = 25 ms / period of each E clock cycle = $\frac{25 \times 10^{-3}}{128} \times 24 \times 10^6 = 4687.5$
Note: I forgot to format the cell in my spreadsheet. 4687.5 became 4688.
- b) Clock frequency = 24 MHz / 64 Period for each E clock = 64 / 24 μs
 # of counts for 40 ms = 40 ms / period of each E clock cycle = $\frac{40 \times 10^{-3}}{64} \times 24 \times 10^6 = 15,000$
- c) Clock frequency = 24 MHz / 32 Period for each E clock = 32 / 24 μs
 The delay time for 33,750 counts = $33,750 \times \frac{32}{24} \times 10^{-6} = 0.045 \text{ sec} = 45 \text{ msec}$
- d) Clock frequency = 24 MHz / 64 Period for each E clock = 64 / 24 μs
 The delay time for 18,750 counts = $18,750 \times \frac{64}{24} \times 10^{-6} = 0.05 \text{ sec} = 50 \text{ msec}$

2. Provide the subroutine for the specific output compare channel as shown in the table above. That means you have to provide four different subroutines. All four Output Compare Channels are not identical.

a) Channel OC1

```

delay10ms  movb  #$90,TSCR1          ; enable TCNT and fast flags clear
            movb  #$07,TSCR2        ; configure prescale factor to 128
            movb  #$02,TIOS         ; enable OC1
            ldd   TCNT
            add   #4688              ; start an output compare operation
            std   TC1                ; with 25 ms time delay
wait_lp2   brclr TFLG1,$02,wait_lp2 ; if equal, C1F in TFLG1 is set to 1
            rts

```

b) Channel OC2

```

delay10ms  movb  #$90,TSCR1          ; enable TCNT and fast flags clear
            movb  #$06,TSCR2        ; configure prescale factor to 64
            movb  #$03,TIOS         ; enable OC2
            ldd   TCNT
            add   #15000             ; start an output compare operation
            std   TC2                ; with 40 ms time delay
wait_lp2   brclr TFLG1,$03,wait_lp2 ; if equal, C2F in TFLG1 is set to 1
            rts

```

c) Channel OC3

```

delay10ms  movb  #$90,TSCR1          ; enable TCNT and fast flags clear
            movb  #$05,TSCR2        ; configure prescale factor to 32
            movb  #$04,TIOS         ; enable OC3
            ldd   TCNT
            add   #33750             ; start an output compare operation
            std   TC3                ; with 45 ms time delay
wait_lp2   brclr TFLG1,$04,wait_lp2 ; if equal, C3F in TFLG1 is set to 1
            rts

```

d) Channel OC4

```

delay10ms  movb  #$90,TSCR1          ; enable TCNT and fast flags clear
            movb  #$06,TSCR2        ; configure prescale factor to 64
            movb  #$10,TIOS         ; enable OC4
            ldd   TCNT
            add   #18750             ; start an output compare operation
            std   TC4                ; with 50 ms time delay
wait_lp2   brclr TFLG1,$10,wait_lp2 ; if equal, C4F in TFLG1 is set to 1
            rts

```