

(سری 5)

(سوال 1)

```
.include "m64def.inc"
.ORG 0x0000
    JMP main
.ORG 0x0020
    JMP Timer0_ISR

.ORG 0x0050
main:
    LDI R16, LOW(RAMEND)
    OUT SPL, R16
    LDI R16, HIGH(RAMEND)
    OUT SPH, R16
    LDI R16, 0x00FF
    OUT DDRA, R16

    LDI R17, 50      ; initial DAC value
    OUT PORTA, R17

    ; timer setup:
    ; prescalar = 1024 -> 10.24Mhz / 1024 = 10000; 1 / 10000 = 0.1ms
    ; count = 2ms / 0.1ms = 20
    ; TCNT0 = 256 - count = 256 - 20 = 236

    LDI R16, 236
    OUT TCNT0, R16    ; counting 236:256
    LDI R16, 0x07      ; CS02:CS00 = 111 (1024)
    OUT TCCR0, R16
    LDI R16, 0x01      ; TOIE0
    OUT TIMSK, R16

    LDI R18, 0         ; phase counter
    LDI R19, 0         ; hold time counter
    LDI R20, 0         ; for count increasing ramps

    SEI

loop: JMP loop

Timer0_ISR:
    LDI R16, 236
    OUT TCNT0, R16

    CPI R18, 0
    BREQ decrease
    CPI R18, 1
    BREQ hold
    CPI R18, 2
    BREQ increase
    RETI

decrease:
    DEC R17            ; DAC from 50 to 0
    OUT PORTA, R17
    CPI R17, 0
    BRNE end0
    LDI R18, 1
end0: RETI

hold:
    INC R19
    CPI R19, 50
    BRNE end1
    LDI R18, 2
    LDI R19, 0         ; reset hold time counter
    LDI R20, 0         ; reset for count increasing
end1: RETI

increase:
    INC R17            ; DAC from 0 to 50
    OUT PORTA, R17
    CPI R17, 50
    BRNE end_timer

    INC R20
    CPI R20, 2
    BREQ inc_second

    LDI R17, 0
    OUT PORTA, R17
    JMP end_timer

inc_second:
    LDI R18, 0

end_timer: RETI
```

```

.INCLUDE 'M64DEF.INC'
.ORG 0x0000
JMP MAIN
.ORG 0x0020
JMP Timer0_ISR
.ORG 0x0050

; 1KHz = 1000 micro second period
; 8MHz / 8 = 1MHz => every tick = 1 micro second
; prescaler 8 => TCCR0 = 0x02
; overflow every 10 ticks => TCNT0 = 246 (256-10=246)
; => each = 10 micro second

MAIN:
LDI R16,low(RAMEND)
OUT SPL,R16
LDI R16,high(RAMEND)
OUT SPH,R16

LDI R16,0x02      ; create 10 micro second => 8000000/8 = 1000000 Hz => 10 * 10^-6 / (1/1000000) = 10 بار
OUT TCCR0,R16
LDI R16,246      ; 256 - 10 = 246
OUT TCNT0,R16
LDI R16,0x01
OUT TIMSK,R16

SBI DDRC,5
CLR R17          ; INC(0) OR DEC(1)
LDI R18,20       ; duty cycle = 20% * 1000us = 200 => 200/10 = 20 تیک
CLR R19          ; شمارنده 0 تا 99 = 100
CLR R20          ; 25 = 24 تا 0 میلیثانیه
CLR R21          ; 250ms شمارنده
SEI

loop: JMP loop

Timer0_ISR:
    LDI R16,246      ; 256 - 10 = 246
    OUT TCNT0,R16

    CP R19,R18      ; اگر شمارنده > duty => HIGH
    BRSH set_low
    SBI PORTC,5
    JMP check

set_low:
    CBI PORTC,5

```

check:

```
CPI R21,25      ; ms = 25 * 10ms = 250ms ; 250
BRNE update_counters
CLR R21
CPI R17,0
BRNE decrease
```

```
LDI R16,15      ; افزایش 15% <= 150 = 1000 * 15% => 150 = 150/10 = 15 تیک
ADD R18,R16      ; R18 += 15
CPI R18,80      ; 80% * 1000 / 10 = 80
BRNE end
LDI R17,1      ; رسیدیم به 80% برو به کاهش ;
```

decrease:

```
; کاهش 10% <= 100 = 1000 * 10% => 100 = 100/10 = 10 تیک
SUBI R18,10
CPI R18,20      ; 20% * 1000 / 10 = 20
BRNE end
LDI R17,0      ; رسیدیم به 20% برو به افزایش ;
```

update\_counters:

```
INC R19
CPI R19,100      ; 100 * 10 = 1000 = 1ms
BRNE end
CLR R19
```

count\_ms:

```
INC R20
CPI R20,10
BRNE end
CLR R20
INC R21
```

end:RETI