

# Homework #7

Illya Starikov

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## Problem #1

$$(65536 - x) \times 1.085 \mu\text{s} = 5 \text{ ms} = 5000 \mu\text{s} \quad (1)$$

$$= 60928_{10} \quad (2)$$

$$= EE00_{16} \quad (3)$$

Therefore, TH1 =  $EE_{16}$  and TL1 =  $00_{16}$

## Problem #2

Assuming Problem #1 is correct,

```
ORG 0H

MOV R0, #100D
LOOP:  MOV TMOD, #01D
        MOV TH0, #EEH
        MOV TLO, #00H    ; (FFFF - EE00 + 1)*1.085 = 5ms
        ACALL DELAY
        DJNZ R0, LOOP    ; 100*5ms = 500 ms

        AJMP DONE

DELAY:  SETB TR0
LOOP2:  JNB TF0, LOOP2
        CLR TR0
        CLR TF0
        RET

DONE:   NOP
        END
```

## Problem #3

5 kHz = 500  $\mu$ s. So,

$$TH1 = EE_{16} \quad \text{and} \quad TL1 = 00_{16} \quad (4)$$

The code is as follows,

```
ORG OH

MOV R0, #100D
CLR P0.0

LOOP:  MOV TMOD, #01D
      MOV TH0, #EEH
      MOV TLO, #00H    ; (FFFF - EE00 + 1)*1.085 = 5ms
      ACALL DELAY

      CJNE R0, #75D, SKIP
      SETB P0.0

SKIP:  DJNZ R0, LOOP    ; 100*5ms = 500 ms

      AJMP DONE

DELAY: SETB TR0
LOOP2: JNB TF0, LOOP2
      CLR TR0
      CLR TF0
      RET

DONE:  NOP
      END
```

## Problem #4

Because we know frequency  $(f) = \frac{1}{\text{period}(T)}$ ,  $\lfloor f \rfloor \implies \lceil T \rceil, \{\forall f, T \in \mathbb{R}^+ \mid f \neq 0, T \neq 0\}$ . Using this, we find the smallest period to be,

$$(FFFF_{16} - FFFF_{16} + 1) \cdot 1.085 \mu\text{s} = 1.085 \mu\text{s} \quad (5)$$

From this, we use  $f = \frac{1}{T} = \frac{1}{1.085} = 0.92 \mu\text{Hz}$ . We do a similar process for lowest frequency.

```

        ORG 0H
        CLR P1.3

LOOP:   MOV TMOD, #01D
        MOV TH0, #0D    ; lowest frequency => highest period
        MOV TL0, #0D    ; highest period => Smallest TH, TL
        SETB P1.3
        ACALL DELAY

        CLR P1.3
        AJMP DONE

DELAY:  SETB TR0
LOOP2:  JNB TF0, LOOP2
        CLR TR0
        CLR TF0
        RET

DONE:   NOP
        END

```

## Problem #5

### Part A

$$\begin{aligned}
 2C_{16} + 11_{16} &\implies 2C11_{16} & (6) \\
 FFFF_{16} - 2C11_{16} + 1_{16} &= D3EF_{16} & (7) \\
 &= 54254_{10} & (8) \\
 &\implies 58\,865.59\,\mu\text{s} & (9) \\
 &= 58.87\,\text{ms} & (10)
 \end{aligned}$$

### Part B

$$\begin{aligned}
 10010011_2 &\implies 93_{16} \implies 147_{10} & (11) \\
 (65536 - 147) \times 1.085 &= 70\,947.07\,\mu\text{s} & (12) \\
 &= 70.95\,\text{ms} & (13)
 \end{aligned}$$