ΕΘΝΙΚΟ ΜΕΤΣΟΒΙΟ ΠΟΛΥΤΕΧΝΕΙΟ

ΣΧΟΛΗ ΗΜ&ΜΥ
Εργαστήριο Μικροϋπολογιστών 1η Εργαστηριακή Άσκηση
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Ομάδα C07

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Άσκηση 1.ii

Χρονόμετρο δευτερολέπτων

```
START:
        CALL BEEP
        LXI B,03E8H
        MVI A,FEH
LOOPA:
        STA 3000H
        CALL DELB
        CPI F0H
        JZ START
        DCR A
        JMP LOOPA
END
```

Άσκηση 2.i

```
START:
        LDA 2000H
        MOV D,A
        RRC
        RRC
        RRC
        RRC
        ANI 0FH
        MOV E,A
        ;E has MSB needed for ANAMMA
        MOV A,D
        ANI 0FH
        MOV D,A
        ;D has LSB needed for SBHSIMO
        CALL ANAMMA
        CALL SBHSIMO
        JMP START
ANAMMA:
        LXI B,0000H
        LXI H,0000H
        MOV C,E
        CALL SHIFTBC
        CALL SHIFTBC
        DAD B
        CALL SHIFTBC
        CALL SHIFTBC
        CALL SHIFTBC
        DAD B
        CALL SHIFTBC
        DAD B
        LXI B,00C8H
        DAD B ;HL has the needed delay
        MOV C,L
        MOV B,H
        ;need to turn on the led(s)
        CALL ONN
        CALL DELB
        RET

SBHSIMO:
        LXI B,0000H
        LXI H,0000H
        MOV C,D
        CALL SHIFTBC
        CALL SHIFTBC
        DAD B
        CALL SHIFTBC
        CALL SHIFTBC
        CALL SHIFTBC
        DAD B
        CALL SHIFTBC
        DAD B
        LXI B,00C8H
```

```
        DAD B ;HL has the needed delay
        MOV C,L
        MOV B,H
        ;need to turn on the led(s)
        CALL OFF
        CALL DELB
        RET
SHIFTBC: ;shifts BC a bit to the left :)
        MOV A,C
        RAL
        CC ROTC
        CNC ROTNC
        RET

ROTNC:
        MOV C,A
        MOV A,B
        RLC
        MOV B,A
        RET
ROTC:
        MOV C,A
        MOV A,B
        RLC
        MOV B,A
        INR B
        RET
ONN:
        MVI A,00H
        STA 3000H
        RET
OFF:
        MVI A,FFH
        STA 3000H
        RET


END
```

Άσκηση 2.ii_α

```
START1:
        MVI E,00H
        MVI D,00H
START:
        CALL SHOW_COUNTERS
        CALL CHECK_INPT
        CALL MDELAY
        CALL INC_COUNT
        CALL SHOW_COUNTERS
        JMP START

CHECK_INPT:
        LDA 2000H
        RAL
        CC DIAKOPH
        RET

SHOW_COUNTERS:
        MOV A,D
        RAL
        RAL
        RAL
        RAL
        CC MHDENISMOS
        ADD E
        CMA
        STA 3000H
        RET

MDELAY:
        CALL MINI_DELAY
        CALL CHECK_INPT
        CALL MINI_DELAY
        CALL CHECK_INPT
```

```
        RET

MINI_DELAY:
        DI
        LXI B,0032H
        CALL DELB ;xwris push kai pop. blepe sel 235
        RET

INC_COUNT:
        MOV A,E
        INR A
        ANI 0FH
        MOV E,A
        RET

INC_INTR:
        MOV A,D
        INR A
        ANI 0FH
        MOV D,A
        RET

DIAKOPH:
        MVI A,0DH
        SIM
        EI
        RET

INTR_ROUTINE:
        CALL MINI_DELAY ;perimene na sta8eropoih8ei to
        PUSH PSW ;6o bit ths maskas sto 1
        PUSH B
        PUSH D
        PUSH H
        CALL BEEP ;tous epirreazei olous
        POP H
        POP D
        POP B
        POP PSW
LP:
        RIM
        RAL
        RAL
        JC LP ;perimene na mhdenistei to 6o bit ths maskas
        CALL MINI_DELAY ;perimene na sta8eropoih8ei
        CALL INC_INTR ;aukshse to metrhth twn diakopwn
        EI ;ksanaenergopoihse tis diakopes
        RET

MHDENISMOS:
        CMC
        RET
END
```

Άσκηση 2.ii_β

```
START1:
        MVI E,00H
START:
        CALL SHOW_COUNTERS
        CALL CHECK_INPT
        CALL MDELAY
        CALL INC_COUNT
        CALL SHOW_COUNTERS
        JMP START

CHECK_INPT:
        LDA 2000H
        RAL
        CC DIAKOPH
        RET

SHOW_COUNTERS:
        MOV A,E
        ANI 0FH
```

```
        CMA
        STA 3000H
        RET

MDELAY:
        CALL MINI_DELAY
        CALL CHECK_INPT
        CALL MINI_DELAY
        CALL CHECK_INPT
        RET

MINI_DELAY:
        DI
        LXI B,0032H
        CALL DELB ;xwris push kai pop. blepe sel 235
        RET

INC_COUNT:
        MOV A,E
        INR A
        ANI 0FH
        MOV E,A
        RET

INC_INTR:
        MOV A,D
        INR A
        ANI 0FH
        MOV D,A
        RET

DIAKOPH:
        MVI A,0DH
        SIM
        EI
        RET

INTR_ROUTINE:
        PUSH B
        PUSH D
        PUSH H
        CALL BEEP
        POP H
        POP D
        POP B
        CALL METRHMA ;metra posoi diakoptes einai on
LP:
        RIM
        RAL
        RAL
        JC LP ;perimene na mhdenistei to 6o bit ths maskas
        CALL MINI_DELAY ;perimene na sta8eropoih8ei
        EI ;ksanaenergopoihse tis diakopes
        RET

MAX_DELAY:
        DI
        LXI B,03E8H
        CALL DELB ;den epirreazei kanenan
        RET

MHDENISMOS:
        CMC
        RET

AUXHSH:
        INR L
        RET

METRHMA:
        LDA 2000H
        LXI H,0000H

ARXH:
        RAL
```

```
95          CC AUXHSH
96          RAL
97          CC AUXHSH
98          RAL
99          CC AUXHSH
100         RAL
101         CC AUXHSH
102         RAL
103         CC AUXHSH
104         RAL
105         CC AUXHSH
106         RAL
107         CC AUXHSH
108         RAL
109         CC AUXHSH
110         CC MHDENISMOS
111         MOV A,L
112         RAL
113         RAL
114         RAL
115         RAL
116         ADD E
117         CMA
118         STA 3000H ;kai deikse to a8roisma tous sta leds
119         CALL MAX_DELAY ;perimene na doume to apotelesma
120         RET
121
122 END
```