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 MINI_DELAY
        CALL CHECK_INPT
        RET
```

```
35
36  MINI_DELAY:
37          DI
38          LXI B,0032H
39          CALL DELB ;xwris push kai pop. blepe sel 235
40          RET
41
42  INC_COUNT:
43          MOV A,E
44          INR A
45          ANI 0FH
46          MOV E,A
47          RET
48
49  INC_INTR:
50          MOV A,D
51          INR A
52          ANI 0FH
53          MOV D,A
54          RET
55
56  DIAKOPH:
57          MVI A,0DH
58          SIM
59          EI
60          RET
61
62  INTR_ROUTINE:
63          CALL MINI_DELAY ;perimene na sta8eropoih8ei to
64          PUSH PSW ;6o bit ths maskas sto 1
65          PUSH B
66          PUSH D
67          PUSH H
68          CALL BEEP ;tous epirreazei olous
69          POP H
70          POP D
71          POP B
72          POP PSW
73  LP:
74          RIM
75          RAL
76          RAL
77          JC LP ;perimene na mhdenistei to 6o bit ths maskas
78          CALL MINI_DELAY ;perimene na sta8eropoih8ei
79          CALL INC_INTR ;aukshse to metrhth twn diakopwn
80          EI ;ksanaenergopoihse tis diakopes
81          RET
82
83  MHDENISMOS:
84          CMC
85          RET
86  END
```

Άσκηση 2.ii_β

```
1   START1:
2           MVI E,00H
3           MVI D,00H
4   START:
5           CALL SHOW_COUNTERS
6           CALL CHECK_INPT
7           CALL MDELAY
8           CALL INC_COUNT
9           JMP START
10
11  CHECK_INPT:
12          LDA 2000H
13          RAL
14          CC DIAKOPH
15          RET
16
17  SHOW_COUNTERS:
18          MOV A,E
19          ANI 0FH
20          CMA
```

```
        STA 3000H
        RET

MDELAY:
        CALL MINI_DELAY
        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
        CC AUXHSH
        RAL
```

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