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
```

```
54          DAD B ;HL has the needed delay
55          MOV C,L
56          MOV B,H
57          ;need to turn on the led(s)
58          CALL OFF
59          CALL DELB
60          RET
61  SHIFTBC: ;shifts BC a bit to the left :)
62          MOV A,C
63          RAL
64          CC ROTC
65          CNC ROTNC
66          RET
67
68  ROTNC:
69          MOV C,A
70          MOV A,B
71          RLC
72          MOV B,A
73          RET
74  ROTC:
75          MOV C,A
76          MOV A,B
77          RLC
78          MOV B,A
79          INR B
80          RET
81  ONN:
82          MVI A,00H
83          STA 3000H
84          RET
85  OFF:
86          MVI A,FFH
87          STA 3000H
88          RET
89
90
91  END
```

Άσκηση 2.ii_α

```
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           CALL SHOW_COUNTERS
10          JMP START
11
12  CHECK_INPT:
13          LDA 2000H
14          RAL
15          CC DIAKOPH
16          RET
17
18  SHOW_COUNTERS:
19          MOV A,D
20          RAL
21          RAL
22          RAL
23          RAL
24          CC MHDENISMOS
25          ADD E
26          CMA
27          STA 3000H
28          RET
29
30  MDELAY:
31          CALL MINI_DELAY
32          CALL MINI_DELAY
33          CALL CHECK_INPT
34          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 OFH
46          MOV E,A
47          RET
48
49  INC_INTR:
50          MOV A,D
51          INR A
52          ANI OFH
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   START:
4           CALL SHOW_COUNTERS
5           CALL CHECK_INPT
6           CALL MDELAY
7           CALL INC_COUNT
8           JMP START
9
10  CHECK_INPT:
11          LDA 2000H
12          RAL
13          CC DIAKOPH
14          RET
15
16  SHOW_COUNTERS:
17          MOV A,E
18          ANI OFH
19          CMA
20          STA 3000H
```

```
21          RET
22
23   MDELAY:
24          CALL MINI_DELAY
25          CALL MINI_DELAY
26          CALL CHECK_INPT
27          RET
28
29   MINI_DELAY:
30          DI
31          LXI B,0032H
32          CALL DELB  ;xwris push kai pop. blepe sel 235
33          RET
34
35   INC_COUNT:
36          MOV A,E
37          INR A
38          ANI 0FH
39          MOV E,A
40          RET
41
42   INC_INTR:
43          MOV A,D
44          INR A
45          ANI 0FH
46          MOV D,A
47          RET
48
49   DIAKOPH:
50          MVI A,0DH
51          SIM
52          EI
53          RET
54
55   INTR_ROUTINE:
56          PUSH B
57          PUSH D
58          PUSH H
59          CALL BEEP
60          POP H
61          POP D
62          POP B
63          CALL METRHMA  ;metra posoi diakoptes einai on
64   LP:
65          RIM
66          RAL
67          RAL
68          JC LP  ;perimene na mhdenistei to 6o bit ths maskas
69          CALL MINI_DELAY  ;perimene na sta8eropoih8ei
70          EI  ;ksanaenergopoihse tis diakopes
71          RET
72
73   MAX_DELAY:
74          DI
75          LXI B,03E8H
76          CALL DELB  ;den epirreazei kanenan
77          RET
78
79   MHDENISMOS:
80          CMC
81          RET
82
83   AUXHSH:
84          INR L
85          RET
86
87   METRHMA:
88          LDA 2000H
89          LXI H,0000H
90
91   ARXH:
92          RAL
93          CC AUXHSH
94          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         CC MHDENISMOS
109         MOV A,L
110         RAL
111         RAL
112         RAL
113         RAL
114         ADD E
115         CMA
116         STA 3000H  ;kai deikse to a8roisma tous sta leds
117         CALL MAX_DELAY  ;perimene na doume to apotelesma
118         RET
119
120     END
```