



## ΕΘΝΙΚΟ ΜΕΤΣΟΒΙΟ ΠΟΛΥΤΕΧΝΕΙΟ

ΣΧΟΛΗ ΗΜ&ΜΥ

Εργαστήριο Μικροϋπολογιστών 1<sup>η</sup> Εργαστηριακή Άσκηση  
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Ομάδα C07

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## Άσκηση 1.ii

Χρονόμετρο δευτερολέπτων

```
1  START:
2      CALL BEEP
3      LXI B,03E8H
4      MVI A,FEH
5  LOOPA:
6      STA 3000H
7      CALL DELB
8      CPI FOH
9      JZ START
10     DCR A
11     JMP LOOPA
12  END
13
14
```

## Άσκηση 2.i

```
1  IN 10H
2  START:
3      LDA 2000H
4      MOV D,A
5      RRC
6      RRC
7      RRC
8      RRC
9      ANI OFH
10     MOV E,A
11     ;E has MSB needed for ANAMMA
12     MOV A,D
13     ANI OFH
14     MOV D,A
15     ;D has LSB needed for SBHSIMO
16     CALL ANAMMA
17     CALL SBHSIMO
18     JMP START
19  ANAMMA:
20     LXI B,0000H
21     LXI H,0000H
22     MOV C,E
23     CALL SHIFTBC
24     CALL SHIFTBC
25     DAD B
26     CALL SHIFTBC
27     CALL SHIFTBC
28     CALL SHIFTBC
29     DAD B
30     CALL SHIFTBC
31     DAD B
32     LXI B,00C8H
33     DAD B ;HL has the needed delay
34     MOV C,L
35     MOV B,H
36     ;need to turn on the led(s)
37     CALL ONN
38     CALL DELB
39     RET
40
41  SBHSIMO:
42     LXI B,0000H
43     LXI H,0000H
44     MOV C,D
45     CALL SHIFTBC
46     CALL SHIFTBC
47     DAD B
48     CALL SHIFTBC
49     CALL SHIFTBC
50     CALL SHIFTBC
51     DAD B
```

```

52     CALL SHIFTBC
53     DAD B
54     LXI B,00C8H
55     DAD B ;HL has the needed delay
56     MOV C,L
57     MOV B,H
58     ;need to turn on the led(s)
59     CALL OFF
60     CALL DELB
61     RET
62     SHIFTBC: ;shifts BC a bit to the left :)
63     MOV A,C
64     RAL
65     CC ROTC
66     CNC ROTNC
67     RET
68
69     ROTNC:
70     MOV C,A
71     MOV A,B
72     RLC
73     MOV B,A
74     RET
75     ROTC:
76     MOV C,A
77     MOV A,B
78     RLC
79     MOV B,A
80     INR B
81     RET
82     ONN:
83     MVI A,00H
84     STA 3000H
85     RET
86     OFF:
87     MVI A,FFH
88     STA 3000H
89     RET
90
91     END
92

```

## 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 CHECK_INPT
33         CALL MINI_DELAY
34         CALL CHECK_INPT
35         RET
36
37     MINI_DELAY:
38         DI
39         LXI B,0032H
40         CALL DELB ;xwris push kai pop. blepe sel 235
41         RET
42
43     INC_COUNT:
44         MOV A,E
45         INR A
46         ANI OFH
47         MOV E,A
48         RET
49
50     INC_INTR:
51         MOV A,D
52         INR A
53         ANI OFH
54         MOV D,A
55         RET
56
57     DIAKOPH:
58         MVI A,ODH
59         SIM
60         EI
61         RET
62
63     INTR_ROUTINE:
64         CALL MINI_DELAY ;perimene na sta8eropoih8ei to
65         PUSH PSW ;60 bit ths maskas sto 1
66         PUSH B
67         PUSH D
68         PUSH H
69         CALL BEEP ;tous epirreazei olous
70         POP H
71         POP D
72         POP B
73         POP PSW
74
75     LP:
76         RIM
77         RAL
78         RAL
79         JC LP ;perimene na mhdenistei to 60 bit ths maskas
80         CALL MINI_DELAY ;perimene na sta8eropoih8ei
81         CALL INC_INTR ;aukshse to metrhth tum diakopum
82         EI ;ksanaenergopoihse tis diakopes
83         RET
84
85     MHDENISMOS:
86         CMC
87         RET
88
89     END

```

## Άσκηση 2.ii\_β

```

1     START1:
2         MVI E,00H
3
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  SHOW_COUNTERS:
18      MOV A,E
19      ANI OFH
20      CMA
21      STA 3000H
22      RET
23
24  MDELAY:
25      CALL MINI_DELAY
26      CALL CHECK_INPT
27      CALL MINI_DELAY
28      CALL CHECK_INPT
29      RET
30
31  MINI_DELAY:
32      DI
33      LXI B,0032H
34      CALL DELB ;xwris push kai pop. blepe sel 235
35      RET
36
37  INC_COUNT:
38      MOV A,E
39      INR A
40      ANI OFH
41      MOV E,A
42      RET
43
44  INC_INTR:
45      MOV A,D
46      INR A
47      ANI OFH
48      MOV D,A
49      RET
50
51  DIAKOPH:
52      MVI A,ODH
53      SIM
54      EI
55      RET
56
57  INTR_ROUTINE:
58      PUSH B
59      PUSH D
60      PUSH H
61      CALL BEEP
62      POP H
63      POP D
64      POP B
65      CALL METRHMA ;metra posoi diakoptes einai on
66  LP:
67      RIM
68      RAL
69      RAL
70      JC LP ;perimene na mhdenistei to 6o bit ths maskas
71      CALL MINI_DELAY ;perimene na sta8eropoih8ei
72      EI ;ksanaenergopoihse tis diakopes
73      RET
74
75  MAX_DELAY:
76      DI
77      LXI B,03E8H
78      CALL DELB ;den epirreazei kanenan
79      RET
80
81  MHDENISMOS:
82      CMC
83      RET
84
85  AUXHSH:
86      INR L
87      RET
88
89  METRHMA:
90      LDA 2000H
91      LXI H,0000H

```

```

92
93  ARXH:
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     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

```