ΕΘΝΙΚΟ ΜΕΤΣΟΒΙΟ ΠΟΛΥΤΕΧΝΕΙΟ

ΣΧΟΛΗ ΗΜ&ΜΥ
Εργαστήριο Μικροϋπολογιστών 1�η Εργαστηριακή Άσκηση
Ακ. έτος 2011-2012

Ομάδα C07

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28 Νοεμβρίου 2011

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 F0H
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 0FH
10         MOV E,A
11         ;E has MSB needed for ANAMMA
12         MOV A,D
13         ANI 0FH
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
92  END
```

Άσκηση 2.ii

```
1   IN 10H
2           MVI E,00H
3           MVI D,00H
4   START:
5           CALL CHECK_INPT
6           CALL MDELAY
7           CALL SHOW_COUNTERS
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          ADD E
25          CMA
26          STA 3000H
27          RET
28  MDELAY:
29          CALL MINI_DELAY
30          CALL CHECK_INPT
31          CALL MINI_DELAY
```

```asm
32          CALL CHECK_INPT
33          RET
34
35  MINI_DELAY:
36          DI
37          LXI B,0032H
38          PUSH B
39          PUSH D
40          CALL DELB
41          POP D
42          POP B
43          RET
44
45  INC_COUNT:
46          MOV A,E
47          INR A
48          ANI 0FH
49          MOV E,A
50          RET
51
52  INC_INTR:
53          MVI H,00H
54          MOV A,D
55          INR A
56          ANI 0FH
57          MOV D,A
58          RET
59
60  DIAKOPH:
61          MVI A,0DH
62          SIM
63          EI
64          RET
65
66  INTR_ROUTINE:
67          PUSH B
68          PUSH D
69          PUSH H
70          CALL BEEP
71          POP H
72          POP D
73          POP B
74          CALL MINI_DELAY
75  LP:     RIM
76          RAL
77          RAL
78          JC LP
79          INR H
80          MOV A,H
81          CPI 02H
82          MOV H,A
83          JZ INC_INTR
84          CALL SHOW_COUNTERS
85          EI
86          CALL MINI_DELAY
87          MVI L,00H
88          CALL METRHMA
89          RET
90
91  MAX_DELAY:
92          DI
93          LXI B,03E8H
94          PUSH H
95          PUSH B
96          PUSH D
97          CALL DELB
98          POP D
99          POP B
100         POP H
101
102 AUXHSH:
103         INR L
104         RET
105
106 METRHMA:
```

```
107         LDA 2000H
108  ARXH:
109         RAL
110         CC AUXHSH
111         RAL
112         CC AUXHSH
113         RAL
114         CC AUXHSH
115         RAL
116         CC AUXHSH
117         RAL
118         CC AUXHSH
119         RAL
120         CC AUXHSH
121         RAL
122         CC AUXHSH
123         RAL
124         CC AUXHSH
125         MOV A,L
126         RAL
127         RAL
128         RAL
129         RAL
130         ADD E
131         CMA
132         STA 3000H
133         CALL MAX_DELAY
134         MOV L,A
135         EI
136         RET
137  END
```