



ΕΘΝΙΚΟ ΜΕΤΣΟΒΙΟ ΠΟΛΥΤΕΧΝΕΙΟ

ΣΧΟΛΗ ΗΜ&ΜΥ
Εργαστήριο Μικροϋπολογιστών

7^η Εργαστηριακή Άσκηση
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Ομάδα C07:

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Άσκηση (i)

Κυρίως κώδικας:

```
1  /*Includes for compatibility with GNU toolchain*/
2  #include <avr/io.h>
3  #include <avr/interrupt.h>
4  #define __SFR_OFFSET 0
5  .global main
6  /*
7   * AVR_3h_ask1.asm
8   *
9   * Created: 10/2/2012 10:01:52 ??
10  * Author: Valia
11  */
12
13
14  /*
15  * AVR_ask1.asm
16  *
17  * Created: 10/2/2012 9:24:48 ??
18  * Author: Valia
19  */
20
21  //.def r24 = r24
22  //.def r28 = r28
23  //.def r27 = r27
24  //.def r25 = r25
25  //.def r29 = r29
26  //.def r26 = r26
27  //.def r30 = r30
28
29  main:
30      ldi r24, hi8(RAMEND)
31      out SPH, r24
32      ldi r24, lo8(RAMEND)
33      out SPL, r24
34
35      ser r24
36      out DDRB, r24
37
38      clr r24
39      out DDRA, r24
40
41      clr r29
42      out DDRC, r29
43  start:
44      clr r30
45      in r29, PINC
46      lsr r29
47      brcc syn1
48  etik1:    //perimenei mexri na ginei 0 (button)
49      in r26, PINC
50      lsr r26
51      brcs etik1
52      ori r30, 1
53
54  syn1:
55      lsr r29
56      brcc syn2
57  etik2:    //perimenei mexri na ginei 0 (button)
58      in r26, PINC
59      lsr r26
60      lsr r26
61      brcs etik2
62      ori r30, 2
63
64  syn2:
65      lsr r29
66      brcc syn3
67  etik3:    //perimenei mexri na ginei 0 (button)
68      in r26, PINC
69      lsr r26
```

```

70     lsr r26
71     lsr r26
72     brcs etik3
73     ori r30, 4
74
75     syn3:
76         lsr r29
77         brcc syn4
78     etik4:    //perimenei meaxri na ginei 0 (button)
79         in r26, PINC
80         lsr r26
81         lsr r26
82         lsr r26
83         lsr r26
84         brcs etik4
85         ori r30, 8
86
87     syn4:
88         lsr r29
89         brcc syn5
90     etik5:    //perimenei meaxri na ginei 0 (button)
91         in r26, PINC
92         lsl r26
93         lsl r26
94         lsl r26
95         lsl r26
96         brcs etik5
97         ori r30, 0x010
98
99     syn5:
100        lsr r29
101        brcc syn6
102     etik6:    //perimenei meaxri na ginei 0 (button)
103        in r26, PINC
104        lsl r26
105        lsl r26
106        lsl r26
107        brcs etik6
108        ori r30, 0x020
109
110     syn6:
111        lsr r29
112        brcc syn7
113     etik7:    //perimenei meaxri na ginei 0 (button)
114        in r26, PINC
115        lsl r26
116        lsl r26
117        brcs etik7
118        ori r30, 0x040
119
120     syn7:
121        lsr r29
122        brcc synexise
123     etik8:    //perimenei meaxri na ginei 0 (button)
124        in r26, PINC
125        lsl r26
126        brcs etik8
127        ori r30, 0x080
128
129     synexise:
130
131        in r28, PINA
132        clr r25    //mhdenismos exodum
133        clr r27
134
135     gate_1:
136        lsr r28
137        brcc exit_gate1    //an to lsb == 0 feugoume
138        lsr r28
139        brcc exit_gate1    //an to 2o lsb == 0 feugoume
140        inc r25
141
142     exit_gate1:
143
144     gate_2:

```

```

145     lsr r28
146     brcc exit_gate2 //an to 3o lsb == 0 feugoume
147     lsr r28
148     brcc exit_gate2 //an to 4o lsb == 0 feugoume
149     ori r27, 2
150
151 exit_gate2:
152     or r27, r25 //exodos sta 2 prwta lsb bit
153
154 gate_3:
155     lsr r28
156     brcs exit_gate3 //an to 5o lsb == 1 feugoume
157     lsr r28
158     brcs exit_gate3 //an to 6o lsb == 1 feugoume
159     ori r27, 4 // or me 100
160
161 exit_gate3:
162
163 gate_4:
164     lsr r28
165     brcs one //an einai 1 psaxnoumt an kai to allo einai 0
166     lsr r28 //an einai to 1o 0, tsekaroyme an kai to 2o einai 1
167     brcc exit_gate4
168     rjmp setting
169
170 one:
171     lsr r28
172     brcs exit_gate4 // an to allo einai 0 feugoyme
173
174 setting:
175     ori r27, 8
176
177 exit_gate4:
178     eor r27, r30 //xor
179     out PORTB, r27
180     rjmp start

```

Άσκηση (ii)

Κυρίως κώδικας:

```

1  /* .....
2
3  * File Name : part2.c
4
5  * Purpose :
6
7  * Creation Date : 07-02-2012
8
9  * Last Modified : Wed 08 Feb 2012 12:09:50 AM EET
10
11 * Created By : Greg Liras <gregliras@gmail.com>
12
13 .....*/
14
15
16 #include<avr/io.h>
17
18 int f0 ( int c )
19 {
20     for( ; c > 0 ; c >=1 )
21         if ( ( c & 3 ) == 3 )
22             return 0;
23     return 1;
24 }
25 int f1 ( int c )
26 {
27     if ( c <= 15 || c == 31 )
28         return 1;
29     return 0;
30 }
31 int main(void)
32 {
33     DDRA = 0xff;
34     DDRC = 0x00;

```

```

35     int f_0;
36     int f_1;
37     int c;
38     for( ;; )
39     {
40         c = PINC & 31;
41         f_0 = f0( c );
42         f_1 = f1( c );
43         PORTA = f_0 | ( f_1 << 1 ) | ( ( f_0 | f_1 ) << 2 );
44     }
45 }

```

Άσκηση (iii)

Κυρίως κώδικας:

```

1  #include <avr/io.h>
2  #define __SFR_OFFSET 0
3
4  .global main
5  main:
6  reset:
7      ldi r24,lo8(RAMEND)
8      out SPL,r24
9      ldi r24,hi8(RAMEND)
10     out SPH,r24
11     ser r24
12     out DDRA,r24
13     // PORTA output
14     ldi r24 ,(1 << PC7) | (1 << PC6) | (1 << PC5) | (1 << PC4)
15     out DDRC ,r24
16     // 4x4 pad input
17
18  lock:
19     rcall scan_keypad
20     cpi r24, 0x12
21     brne lock
22     rjmp pass
23
24  pass:
25     ldi r24,0xff
26     out PORTA, r24
27     ldi r24,lo8(2000)
28     ldi r25,hi8(2000)
29     rcall wait_msec
30     ldi r24,0x00
31     out PORTA, r24
32     rjmp lock
33
34
35  scan_row:
36     ldi r25 ,0x08
37  back_: lsl r25
38     dec r24
39     brne back_
40     out PORTC ,r25
41     nop
42     nop
43     in r24 ,PINC
44     andi r24 ,0x0f
45     ret
46
47
48
49  scan_keypad:
50     ldi r24 ,0x01
51     rcall scan_row
52     swap r24
53     mov r27 ,r24
54     ldi r24 ,0x02
55     rcall scan_row
56     add r27 ,r24
57     ldi r24 ,0x03
58     rcall scan_row
59     swap r24

```

```

60     mov r26 ,r24
61     ldi r24 ,0x04
62     rcall scan_row
63     add r26 ,r24
64     movw r24 ,r26
65     ret
66
67
68
69
70     wait_usec:
71         sbiw r24,1
72         nop
73         brne wait_usec
74         ret
75
76     wait_msec:
77         in r27,PINB
78         ror r27
79         brcs wait_msec
80         push r24
81         push r25
82         ldi r24,lo8(998)
83         ldi r25,hi8(998)
84         rcall wait_usec
85         pop r25
86         pop r24
87         sbiw r24,1
88         brne wait_msec
89         ret

```

Άσκηση (iv)

Κυρίως κώδικας:

1

Άσκηση (v)

Κυρίως κώδικας:

1

Άσκηση (vi)

Κυρίως κώδικας:

1

Άσκηση (vii)

Κυρίως κώδικας:

1