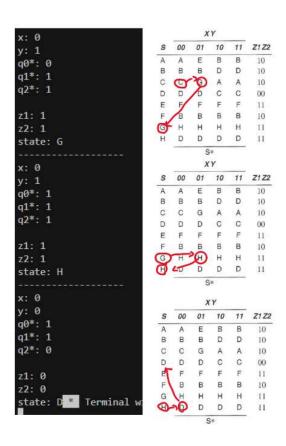
Practice Assignment 3

Part A+B

20						
x: 0			X			
y: 0	s	00	01	10	11	Z1 Z2
The state of the s		A	E	В	В	10
Maria de Carlo	В	В	В	D	D	10
q1*: 0	C	C	G D	A	A	10
q2*: 0	E	F	F	F	F	11
	F	В	В	В	В	10
z1: 1	G	Н	н	Н	н	11
z2: 0	Н	D	D	D	D	11
state: A		712-25	S	0	_	
x: 1			Х	Y		
y: 0	S	00	01	10	11	Z1 Z2
q0*: 1	A	Α	E -	(3)	В	10
q1*: 0	В	В	В	0	D	10
	C	C	G	A	A	10
12*: 0	D	D	D	C	C	00
200 W.C.	E	F	F	F	F	11
1: 1	F	В	В	В	В	10
z2: 0	G	Н	H	Н	Н	11
tate: B	Н	D	D	D	D	11
				*		
x: 0		-00	_	10		Z1 Z2
/: 0	S	00	01	10	11	
q0*: 1	A B	A B	E	. D	B	10 10
11*: 0	9	C	G	. A	A	10
	D	D	D	C	C	00
2*: 0	E	F	F	F	F	11
THOSE DATABLE	F	В	В	В	В	10
1: 1		Н	Н			
	G			H	H	1.1
2: 0	G H	D	D	H	H	11
	H		D	D		11
			D	D S*		
state: B	н	D	D	D S*	D	11
state: B k: 1	H S	D 00	D S	D S* XY 10	D 11	11 Z1 Z2
state: B <: 1 /: 1	S A	00 A	D 5	D S* XY 10 B	11 B	11 Z1 Z2 10
:tate: B : :: 1 :: 1 :: 1	S A B	00 A B	01 E B	D S* XY 10 B	11 B	21 Z2 10 10
tate: B :: 1 :: 1 0*: 1 1*: 1	S A B C	00 A B	01 E B	D S* XY 10 B D	11 B A	21 22 10 10 10
state: B 	H S ABC	00 A B	D S S S S S S S S S S S S S S S S S S S	D S* XY 10 B D A C	11 B A C	21 22 10 10 10 10
x: 1 x: 1 x: 1 x: 1 x: 1 x: 1 x: 1 x: 0	H S A B C O E	00 A B D F	O1 E B G D F	D S* XY 10 B D A C F	11 B A C F	21 Z2 10 10 10 00 11
state: B 	H S ABC	00 A B	D S S S S S S S S S S S S S S S S S S S	D S* XY 10 B D A C	11 B A C	21 Z2 10 10 10 10 00
tate: B :: 1 :: 1 10*: 1 11*: 1 12*: 0 11: 0	S A B C O E F	00 A B C D F B	O1 E B G D F B	D Ss* XY 10 B D A C F B	D B A C F B	21 Z2 10 10 10 10 00 11 10
state: B 	A B C OE F G	00 A B C D F B H	O1 E B G D F B H D	D S** XY 10 B D A C F B H	D B A C F B H	11 21 22 10 10 10 00 11 10 11
B. (15)	A B C OE F G	00 A B C D F B H	01 E B G D F B H D	D S* XY 10 B D A C F B H D S*	D B A C F B H	11 21 22 10 10 10 00 11 10 11
state: B c: 1 p: 1 q0*: 1 q1*: 1 q2*: 0 p: 2: 0 state: D c: 1	A B C O E F G H	00 A B C D F B H D	01 E B G D F B H D	D S* XY 10 B D A C F B H D S*	D B D A C F B H D	21 Z2 10 10 10 00 11 10 11 11
tate: B :: 1 :: 1 0*: 1 1*: 1 2*: 0 1: 0 2: 0 tate: D :: 1	H S A B C D E F G H S	00 A B C D F B H D	01 E B G D F B H D D 01	D	11 B D A C F B H D	21 Z2 10 10 10 00 11 10 11 11 11
tate: B : 1 : 1 0*: 1 1*: 1 2*: 0 1: 0 2: 0 tate: D : 1	H S A B C O E F G H S A	00 A B B H D	01 E B G D F B H D D 011 E	D	11 B Q A C F B H D	21 22 10 10 10 00 11 10 11 11 11
tate: B	H S A B C O E F G H S A B	00 A B H D	01 E B G D F B H D D 01	D D A C F B H D D S*	D	2122 10 10 10 10 00 11 10 11 11 2122 10 10
tate: B :: 1 :: 1 :: 1 :: 1 :: 2*: 0 :: 1 :: 0 :: 1 :: 1 :: 1 :: 1 :: 1 :	H S A B C O E F G H S A B	00 A B C D F B H D 000 A B C	D	D D A C F B H D S S * XY 10 B D A A C A A A A A A A A A A A A A A A A	11 B Q A C F B H D	2122 10 10 10 10 10 11 11 11 2122 10 10 10 10 10 10 10 10 10 10
state: B c: 1 c: 1 d0*: 1 d1*: 1 d2*: 0 c1: 0 c2: 0 state: D c: 1 c: 1 d0*: 0 d1*: 1	H S A B C O E F G H S A B	00 A B H D	D	D D A C F B H D S S * X Y 10 B D A C C F A C C C C C C C C C C C C C C C	D	2122 10 10 10 10 00 11 10 11 11 2122 10 10
tate: B :: 1 :: 1 :: 1 :: 1 :: 1 :: 0 :: 0 :: 1 :: 1	H S A B C D E F G H S A B C D	00 A B C D A B C D	01 E B G D F B B H D D E B G G D D	D D A C F B H D D A C C F A C C F C C C C C C C C C C C C	111 B D A C F B H D D A C C	2122 10 10 10 10 10 11 11 11 2122 10 10 10 10 10 10 10 10 10 10
tate: B : 1 : 1 0*: 1 1*: 1 2*: 0 1: 0 2: 0 tate: D : 1 : 1 0*: 0 1*: 1 2*: 0	H S ABCOEFGH S ABOOE	00 A B C D F B H D D F F B H D D F F B H D D F F B H D D F F B H D D F F B H D D F F B D F F B D F F B D F F B D F F B D F F B D D F F B D D F F B D D F F B D D F F B D D F F B D D F F B D D F F B D D F F B D D F F B D D F F B D D F F B D D F F B D D F F B D D F F B D D F D D D D	O1 E B G D F B B H D D F B G G D F	D D A C F B H D D A C C F B C C F C C C F C C C C C C C C C	111 B D A C F B H D D A C C F	2122 10 10 10 00 11 11 11 21 22 12 10 10 10 10 10 10 10 10 10 10 10 10 10
tate: B : 1 : 1 0*: 1 1*: 1 2*: 0 1: 0 2: 0 tate: D : 1 : 1 0*: 0 1*: 1 2*: 0	H S A B C DEFGH S A B D D E F	00 A B C D F B H D OO A B C D F B	01 E B G D F B B G D F F B	D D A C F B H D D A C C F B D A C C F B D D A C C F B D D D A C C F B D D D A C C F B B D D A C C F B B D D A C C F B B D D A C C F B B D D A C C F B B D D A C C F B B D D A C C F B B D D A C C F B B D D A C C F B B D D D D D D D D D D D D D D D D D	111 B D A C F B B D A C F B	2122 10 10 10 10 10 11 11 11 11 11 10 10 10 1
tate: B : 1 : 1 0*: 1 1*: 1 2*: 0 1: 0 2: 0 tate: D : 1 : 1 0*: 0 1*: 1 2*: 0	H	00 A B C D F B H D A B C D F B H	01 E B G D F B B H D D F B B H D	D D A C F B H D A C F B H D A C F B H D A C F B H D A C F B H D A C F B H D A C F B H D A C F B H D A C F B H D A C C F B H D A C C F B H D A C C F B H D A C C F B H D A C C F B H D A C C F B H D A C C F B H D A C C F B H D A C C F B H D A C C F B H D B H D A C C F B H D B H D D A C C F B H D D A C C F B H D D A C C F B H D D A C C F B H D D A C C F B H D D A C C F B H D D A C C F B H D D A C C F B H D D A C C F B H D D A C C F B H D D A C D D D D D D D D D D D D D D D D	111 B D A C F B H D A C F B H	2122 10 10 10 10 11 11 11 11 11 11 11 11 11 1
tate: B : 1 : 1 0*: 1 1*: 1 2*: 0 1: 0 2: 0 tate: D : 1 : 1 0*: 0 1*: 1 2*: 0	H	00 A B C D F B H D A B C D F B H	O1 E B G D F B B H D D F B B H D	D D D A C F B H D D A C F B H D S *	111 B D A C F B H D A C F B H	2122 10 10 10 10 11 11 11 11 11 11 11 11 11 1
tate: B :: 1 :: 1 :: 1 :: 1 :: 1 :: 0 2: 0 :tate: D :: 1 :: 1 :: 1 :: 1 :: 1 :: 1 :: 2*: 0 :1: 1 :: 0 :1: 0 :1: 1 :1 1 :1 1 :1	H S ABCOMFGH S ABODEFGH	00 A B C D F B H D OO A B C D F B H D	O1 E B G D F B B H D D F B B H D D	D D S XY 10 B D A C F B H D D A C F B H D S S XY 10 B C F S S XY 10 B C F S S XY T C C C C C C C C C C C C C C C C C C	D A C F B H D A C F B B H D	2122 2122 10 10 10 10 10 11 11 11 2122 10 10 10 10 10 11 11 11 11 11
tate: B :: 1 :: 1 0*: 1 1*: 1 2*: 0 1: 0 2: 0 :tate: D :: 1 0*: 0 1*: 1 2*: 0 1: 1 2*: 0 1: 1 2*: 0 1: 1 2*: 0	H S ABCOMFGH S ABCOMFGH S	00 A B C D F B H D 00 A B C D F B H D	01 E B G D F B H D D F B H D D 01	D D A C F B H D A C F B H D S ** ** ** ** ** ** ** ** **	111 B D A C F B H D A C F B B H D T 111	2122 2122 10 10 10 10 10 11 11 11 2122 2122
state: B c: 1 c: 1 d0*: 1 d1*: 1 d2*: 0 c1: 0 c2: 0 state: D c: 1 d2*: 0 d1: 1 d2*: 0 c1: 1	H S ABCOMFGH S ABODEFGH S A	00 A B C D F B H D D F B H D A B C D F B H D D A B C D F B H D D F B H D D A A B C D F B H D D A A B C D D F B H D D A A B C D D F B H D D A A B C D D F B H D D A A B C D D F B H D D A A B C D D F B H D D A A B C D D F B H D D A A B C D D F B H D D A A B C D D F B H D D D A A B C D D F B H D D D D D D D D D D D D D D D D D D	01 E B G D F B B H D D F B B B H D D F B B B B B B B B B B B B B B B B B	D D XYY 10 B D A C F B H D D A C F B H D S * * * * * * * * * * * * * * * * * *	11 B D A C F B B H D A C F B B H D B D A C F B B H D D A C F B B H D D A C F B B H D D B B B H D D B B B B B B B B B	2122 2122 10 10 10 10 10 11 11 11 11 2122 10 10 10 10 11 11 11 11 11 12 13 14 15 16 16 16 16 17 17 18 18 18 18 18 18 18 18 18 18
state: B c: 1 c: 1 d0*: 1 d1*: 1 d2*: 0 c1: 0 c2: 0 state: D c: 1 d0*: 0 d1*: 1 d2*: 0 c1: 1 c2: 0 c1: 1 d2*: 0 c1: 1 d2*: 0 d1*: 1 d2*: 0 d1*: 1	H S ABCOEFGH S ABOOLFGH S AB	00 A B C D F B H D 00 A B C D F B H D	01 E B G D F B B H D D F B B H D D E B B H D D	D D A C F B H D A C F B H D S S T 10 B D A C F B H D D B D A C B D D B D D D D D D D D D D D D D D D	111 B D A C C F B B H D D A C C F B B H D D A C C F B B H D D A C C F B B H D D A C C F B B H D D A C C F B B H D D D D D D D D D D D D D D D D D	2122 10 10 10 10 10 11 11 11 2122 10 10 10 10 11 11 11 11 11 11 11 11 11
state: B	H S ABCOEFGH S ABCO	00 A B C D F B H D 00 A B C	011 E B G D F F B H D D F F B H D D F F B H D D F F B H D D F F B H D D F F B H D D F F B H D D F F B B B H D D F F B B B H D D F F B B B H D D F F B B B H D D F F B B B B B B B B B B B B B B B B	D A C F B H D A C F B H D S * * * * * * * * * * * *	D A C F B H D A C F B B H D A C A C A A C A A C A A C A A C A A C A A A C A A A C A	2122 10 10 10 10 10 11 11 11 2122 10 10 10 10 11 11 11 11 10 10
state: B c: 1 p: 1 post: 1 post: 0 post: 0 post: 0 post: 1 post: 0 post: 0 post: 0 post: 0 post: 0 post: 0 post: 1 post: 0 post: 0 post: 1 post: 0	H S ABCOMFGH S ABCO	00 A B C D F B H D 00 A B C D F B H D	01 E B B H D D F B B H D D F B B H D D F B B H D D F B B H D D F B B H D D F B B B D D F B B B D D D T D D D D D D D D D D D D D	D XY 10 B A C F B H D A C F B H D A C F B C F B A C A C F B A C A C F B A C A C A C A C A C A C A C A C A C C	111 B D A C F B H D A C F B A C C F B C C C F B C C C C C C C C C C C	2122 10 10 10 10 10 10 11 11 11 2122 10 10 10 10 10 11 11 11 11 10 10
x: 1 y: 1 q0*: 1 q1*: 1 q2*: 0 z1: 0 z2: 0 state: D x: 1 y: 1 q0*: 0 q1*: 1 q2*: 0 z1: 1 z2: 0 state: C x: 0 y: 0 q1*: 1 q2*: 0 q1*: 1 q2*: 0	H S ABCOMFGH S ABCOM	00 A B C D F B H D 00 A B C D F	011 E B G D F B B H D D F B B G D F B B H D D F B B G D F B B H D D F F B B G D F F B D F F B D F D F D F D F D F D F	D	D A C F B H D A C F B H D A C F	2122 100 100 100 100 111 111 2122 100 101 101
state: B	H S ABCOMFGH S ABCOMF	00 A B C D F B H D 00 A B C D F B H D	O1 EB G D F B H D D F B B G D F B B G D F B B B B B B B B B B B B B B B B B B	D D A C F B H D A C F F B H D A A C F F B H D A A C F F B H D A A C F F B D A A C C F B B D A A C C F B B D A A C C F B B D A C C F B B D A C C F B B D A C C F B B D A C C F B B D A C C C F B B D A C C C F B B D A C C C C C C C C C C C C C C C C C C	111 B D A C F B H D T T B D A C F B B D A C F B	2122 200 100 100 100 101 101 101
tate: B :: 1 :: 1 :: 1 :: 1 :: 1 :: 2*: 0 :: 1 :: 1 :: 1 :: 1 :: 1 :: 1 :: 1 :	H S ABCOMFGH S ABCOM	00 A B C D F B H D 00 A B C D F F B H D F F B F F B F F B F F B F F B F F F B F F F F B F	011 E B G D F B B H D D F B B G D F B B H D D F B B G D F B B H D D F F B B G D F F B D F F B D F D F D F D F D F D F	D	D A C F B H D A C F B H D A C F	2122 100 100 100 100 111 111 2122 100 101 101



18/03/2025, 13:09 main.c

src\main.c

```
1 /*
 2
    * HelloWorld.c
 3
     * Created: 11/9/2023 10:43:27 AM
 4
 5
    * Author : Alin
 6
    */
 7
 8
 9
10 #include <stdio.h>
11 #include <avr/io.h>
   #include <util/delay.h>
12
13
   #include "usart.h"
14
   #include "i2cmaster.h"
15
16
17
   unsigned char x, y, z1, z2; //creating the variables
18
   unsigned char q0, q1, q2, q0_next, q1_next, q2_next;
19
20
   void read_xy_values(void); //checking which button is pressed and overriding the global
    variables x and y depending on which button is pressed
   void show_output(void); //printing the state to the serial monitor
21
   void state_transition(void); //changing states depending in the input
23
24
25
   int main(void) {
26
      uart_init(); // open the communication to the microcontroller
27
      io_redirect(); // redirect input and output to the communication
28
29
      i2c_init(); //initializing the communication protocoll
30
31
      DDRC = 0b00110000; //setting the registers as inputs for the buttons (5 and 4 are for
   i2c)
      PORTC = 0b00111111; //setting the pullup resistors high for the buttons so we can check
32
    if they're pressed
33
      DDRD = 0b11110000; //setting the registers as outputs for the LEDS
34
35
      PORTD = 0b00000000; // turning the leds off
36
37
      q0 = 0; //setting the inputs initially to zero
38
      q1 = 0;
39
      q2 = 0;
40
41
42
43
      while(1) {
44
            read_xy_values(); //calling the xy_read value function
45
        state_transition(); //calling the state_transition function
46
47
        q0 = q0_next; //setting the current state equal to the next state, so the next state
   would become the current
48
        q1 = q1_next;
```

```
49
         q2 = q2_next;
50
 51
         show_output(); //calling the show_output function
 52
         _delay_ms(1000);
 53
 54
      }
 55
 56
       return 0;
57
58
59
    void read_xy_values(void){ //this function overrides the global variables x and y
     depending on which button is pressed
60
61
      if (!(PINC & (1 << PC6)) && !(PINC & (1 << 7))){
 62
 63
        y=0;
 64
       }
65
      if (!(PINC & (1 << PC2))){
66
 67
         x=1;
 68
        y=0;
       }
 69
70
71
72
73
      if (!(PINC & (1 << PC3))){
74
         x=0;
 75
        y=1;
76
      }
77
78
      if (!(PINC & (1 << PC2)) && !(PINC & (1 << PC3))){
 79
        x=1;
 80
        y=1;
 81
       }
 82
 83
 84
    }
85
    void show_output(void){ //this function prints to the serial monitor, it prints the value
    of x and y and the current state
      char disp = ' ';
 87
       printf("\n----");
 88
      printf("\nx: %d", x);
89
90
      printf("\ny: %d", y);
91
92
       if (q2==0 \&\& q1==0 \&\& q0 ==0){
93
         disp = 'A';
94
95
      if (q2==0 && q1==0 && q0 ==1){
96
         disp = 'B';
97
98
       if (q2==0 && q1==1 && q0 ==0){
         disp = 'C';
99
100
       }
```

```
101
       if (q2==0 && q1==1 && q0 ==1){
102
         disp = 'D';
103
104
      if (q2==1 && q1==0 && q0 ==0){
105
        disp = 'E';
106
107
      if (q2==1 && q1==0 && q0 ==1){
         disp = 'F';
108
109
110
      if (q2==1 && q1==1 && q0 ==0){
         disp = 'G';
111
112
113
       if (q2==1 && q1==1 && q0 ==1){
114
         disp = 'H';
115
116
117
      z2 = (q2&&q1)||(q2&&(!q0));
118
      z1 = (!q0)||(!q1)||(q2);
119
120
     printf("\nq0*: %d", q0_next);
121
      printf("\nq1*: %d", q1_next);
      printf("\nq2*: %d", q2_next);
122
123
      printf("\n\nz1: %d\nz2: %d", z1,z2);
124
      printf("\nstate: %c", disp);
125
    }
126
127
    void state_transition(void){ //this function switches between states, depending on the x
    and y inputs
128
      PORTD=0b00100000;
129
130
      q0_next = ((!q1) && x) || (q0 && (!x)) || (q2); //transition equations
      q1_next = ((!q2) && q0 && x) || (q1 && (!x)) || (q2 && q1);
131
      q2_{next} = (!q0) && (q2 || ((!x) && y));
132
133
134
       _delay_ms(100);
135
      PORTD=0b00000000; //flashes the led
136 }
```

Part C

--- More detai --- Quit: Ctrl

x: 0 y: 0 A_state

x: 0 y: 0 A_state

x: 1 y: 0 B_state

x: 0 y: 0 B_state

x: 0 y: 1 B_state

x: 0 y: 0 B_state

s	00	01	10	11	Z1 Z2
Α	A	E	В	В	10
В	В	В	D	D	10
C	C	G	Α	Α	10
D	D	D	C	C	00
E	F	F	F	F	11
F	В	В	В	В	10
G	Н	Н	Н	Н	11
Н	D	D	D	D	11

s	S 00		10	11	Z1 Z2
Α	(A)	E	B	В	10
В	В	В	D	D	10
C	C	G	Α	Α	10
D	D	D	C	C	00
E	F	F	F	F	11
F	В	В	В	В	10
G	H	Н	H	Н	11
Н	D	D	D	D	11

s	00	01	10	11	Z1 Z2
Α	Α	E	В	В	10
В	B	B	D	D	10
C	ć	G	A	A	10
D	D	D	C	C	00
E	F	F	F	F	11
F	В	В	В	В	10
G	Н	Н	Н	Н	11
Н	D	D	D	D	11
				_	

		X					
s	00	01	10	11	Z1 Z2		
Α	(A)	E	В	В	10		
В	В	В	D	D	10		
C	C	G	A	A	10		
D	D	D	C	C	00		
E	F	F	F	F	11		
F	В	В	В	В	10		
G	Н	Н	H	Н	11		
Н	D	D	D	D	11		

s	00	01	10	11	Z1 Z2		
A	Α	E	В	В	10		
B)-	B	В	D	D	10		
C	C	G	Α	Α	10		
D	D	D	C	C	00		
E	F	F	F	F	11		
F	В	В	В	В	10		
G	Н	Н	Н	H	11		
Н	D	D	D	D	11		

s	00	01	10	11	Z1 Z2
Α	Α	E	В	В	10
В	0	B	D	D	10
C	C	G	Α	Α	10
D	D	D	C	C	00
E	F	F	F	F	11
F	В	В	В	В	10
G	Н	Н	H	Н	11
Н	D	D	D	D	11

x: 1 y: 1 D_state x: 0 y: 0 D_state x: 1 y: 0 C_state x: 0 y: 0 C_state x: 0 y: 1 **G_state** x: 0 y: 0

			х			
	A	00 A	01	10 B	11 B	Z1 Z2 10
x: 1	В	B	В	D	@	10
	C	CD	G	A	A	10
y: 1	Ε	F	F	F	F	11
	F	В	В	В	В	10 11
D_state	н	D	D	D	D	11
			X	′		
and the second	s	00	01	10	(3)///	Z1 Z2
x: 0	A B	В	В	B D	B D	10 10
	<u>6</u>	CO	G	A	A C	10
y: 0	E	F	D F	C F	F	00 11
	F	В	В	В	В	10
D_state	G H	H D	H	H	H	11
_			λ	Y		
	s	00	01	10	11	Z1 Z2
x: 1	A B	В	В	B	B	10
	С	C	G	A	Α	10
y: 0	D E	₽ F	D	P	C	00 11
	F	В	В	В	В	10
C_state	G	Н	Н	Н	Н	11
	Н	D	D)	D	D	- 11
	s	00	01	10	11	Z1 Z2
x: 0	Α	Α	E	В	В	10
	B	B	B	D	D	10 10
y: 0	D	D	D	C	C	00
	E	F	F	F	F	11
C_state	F	В	В	В	В	10 11
_	Н	D	D	D	D	11
			х			
x: 0	<i>s</i>	00 A	01 E	10 B	11 B	Z1 Z2
	В	В	В	D	D	10
y: 1	C	0	0	A	A	10
	D	D	D	F	C	00 11
G state	F	В	В	В	В	10
_	G	H	H	H	H	11 11
				XY		11
x: 0	s	00	01	10	11	
Λ	A B	A B	В	B	B	10 10
y: 0	C	С	G	Α	Α	10
	D	D	D	C	C	00 11
H state	F	В	В	В	В	10
	(G))—Œ	H	Н	Н	11
* Terminal will	Н	D	D	D	D	- 11

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src\main.c

```
1 /*
 2
    * HelloWorld.c
 3
 4
    * Created: 11/9/2023 10:43:27 AM
 5
    * Author : Alin
    */
 6
 7
 8
 9
10 #include <stdio.h>
11 #include <avr/io.h>
   #include <util/delay.h>
12
13
14
   #include "usart.h"
15
   #include "i2cmaster.h"
16
17
   typedef enum { //using enumrated types to represent the ststes
18
      A_state,
19
      B_state,
20
      C_state,
21
      D_state,
22
      E_state,
23
      F_state,
24
      G_state,
25
      H state
   } state;
26
27
28
   unsigned char x, y, z1, z2; // creatung the variables
29
30
   //X AND Y ARE USED AS GLOBAL VARIABLES!!!!
31
32 void read_xy_values(void); //checking which button is pressed and overriding the global
   variables x and y depending on which button is pressed
   state state_transition(state); //changing states depending in the input
34
   void print_state(state); //printing the state to the serial monitor
35
   int main(void) {
36
37
38
      uart_init(); // open the communication to the microcontroller
      io_redirect(); // redirect input and output to the communication
39
40
      i2c_init(); //declaring the communication protocoll
41
42
      state current_state, next_state; //creating the state types
43
      current_state = A_state; //we start with state A
44
45
      DDRC = 0b00110000; //setting the registers as inputs for the buttons (5 and 4 are for
    i2c)
46
      PORTC = 0b00111111; //setting the pullup resistors high for the buttons so we can check
   if they're pressed
47
48
      DDRD = 0b11110000; //setting the registers as outputs for the LEDS
      PORTD = 0b00000000; // turning the leds off
49
```

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```
50
51
52
      while(1) {
53
        read_xy_values(); //calling the xy_read value function
54
        next_state = state_transition(current_state); //declaring the next state with the
55
    function state transition which takes the current state as an input parameter
        current_state = next_state; //setting the current state equal to the next state, so
56
    the next state would become the current
57
58
        printf("\nx: %d\ny: %d\n", x,y); //printing the x and y values for checking
        print_state(current_state); //printing the state
59
60
61
        _delay_ms(1000);
62
63
      }
64
      return 0;
65
    }
66
67
68
    void read xy values(void){ //this function overrides the global variables x and y
    depending on which button is pressed
        if (!(PINC & (1 << PC6)) && !(PINC & (1 << 7))){
69
70
          x=0;
71
          y=0;
72
        }
73
        if (!(PINC & (1 << PC2))){
74
          x=1;
75
          y=0;
76
        }
77
        if (!(PINC & (1 << PC3))){
78
          x=0;
79
          y=1;
80
        if (!(PINC & (1 << PC2)) && !(PINC & (1 << PC3))){
81
82
          x=1;
83
          y=1;
84
        }
85
      }
86
87
88
    void print_state(state state_to_print){ //this function prints which state is the program
89
      switch(state_to_print){
90
        case A_state: printf("A_state \n"); break;
        case B_state: printf("B_state \n"); break;
91
        case C state: printf("C state \n"); break;
92
93
        case D_state: printf("D_state \n"); break;
94
        case E_state: printf("E_state \n"); break;
95
        case F_state: printf("F_state \n"); break;
        case G_state: printf("G_state \n"); break;
96
97
        case H_state: printf("H_state \n"); break;
98
   }
99
```

```
100
101
102
     state state_transition(state current_state){ //this function changes states depening on
     which state the program is in and the given x and y inputs
       PORTD=0b00100000; //flashing one of the leds
103
104
105
       switch (current_state) {
106
         case A_state:
             if (x == 0 && y == 0)
107
108
                 return A state;
             if (x == 0 && y == 1)
109
110
                 return E state;
111
             if (x == 1 && y == 0)
112
                 return B_state;
113
             if (x == 1 && y == 1)
114
                  return B_state;
115
             break;
116
117
         case B_state:
118
             if (x == 0 && y == 0)
                  return B state;
119
120
             if (x == 0 && y == 1)
121
                 return B_state;
122
             if (x == 1 && y == 0)
123
                 return D_state;
124
             if (x == 1 && y == 1)
125
                 return D_state;
126
             break;
127
128
         case C_state:
129
             if (x == 0 && y == 0)
130
                 return C_state;
131
             if (x == 0 && y == 1)
132
                 return G_state;
133
             if (x == 1 && y == 0)
134
                 return A_state;
135
             if (x == 1 && y == 1)
136
                  return A_state;
137
             break;
138
139
         case D_state:
140
             if (x == 0 && y == 0)
141
                 return D state;
142
             if (x == 0 && y == 1)
143
                  return D_state;
             if (x == 1 && y == 0)
144
145
                 return C_state;
146
             if (x == 1 && y == 1)
147
                 return C_state;
148
             break;
149
150
         case E_state:
151
             return F_state;
152
             break;
```

```
153
154
         case F_state:
155
             return B_state;
156
             break;
157
158
         case G_state:
159
             return H_state;
160
             break;
161
162
         case H_state:
163
             return D_state;
164
             break;
165
166
167
168
       _delay_ms(100);
       PORTD=0b00000000;
169
170
171
       return current_state;
172 }
```