UCSD CSE140L Spring 2014

LAB#2 Report

Demonstration Date : 05 / 01 /14 Student CID_____580_____

Student Name: _____Adrian__Jimenez_____

first M.I. Last

TED Submission Date & Time : May 1, 2014 10:35am

(FILLED BY Student BEFORE DEMO)

Self-test Report

	Working	Not working
Part1:	____X_____	_____
Part2:	____X_____	_____
Part3:	____X_____	_____
Part4:	____X_____	_____
Part5:	____X_____	_____

(*** FILLED BY TUTOR/INSTRUCTOR ***)

Demo Reviewer Name : _____

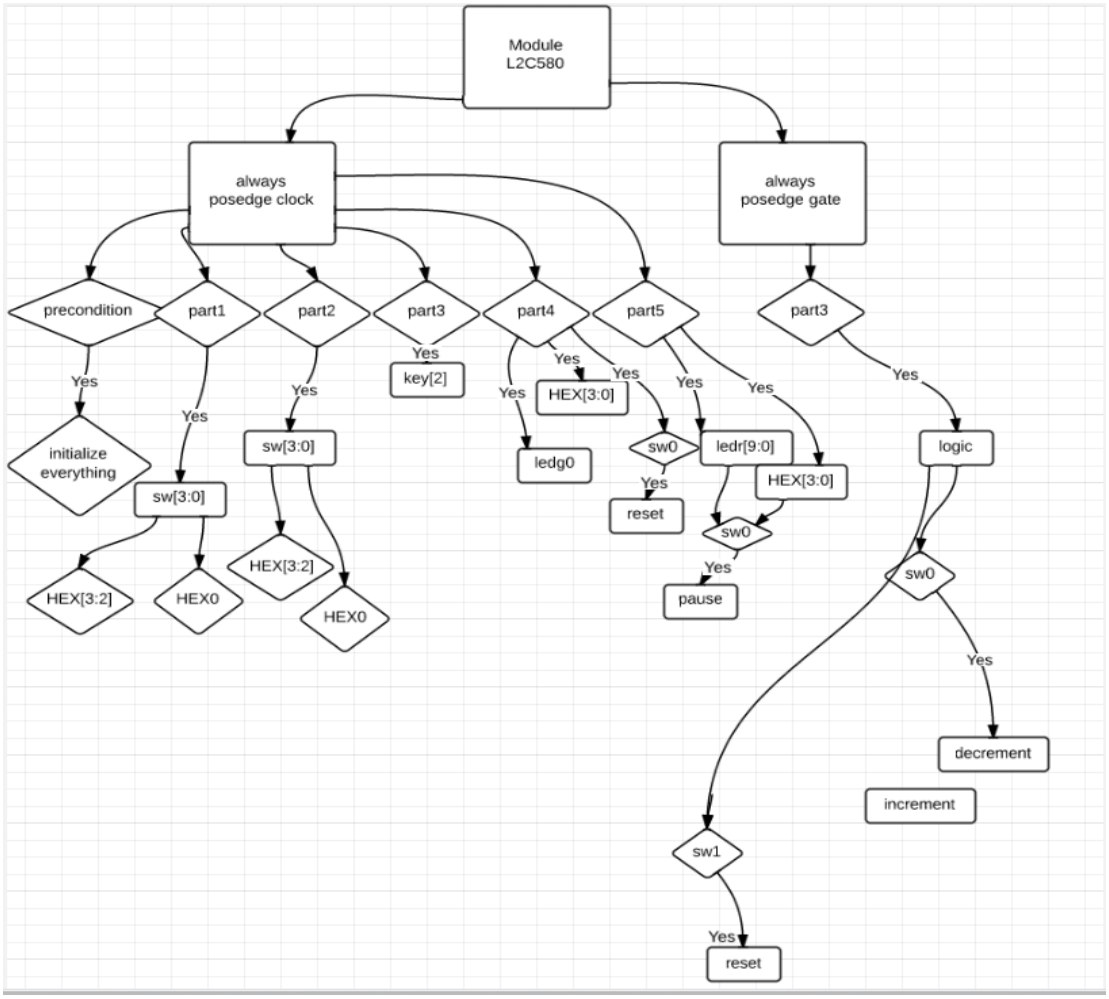
Demo score	**Report** score
_____/**2**	a)_____/**1**
_____/**2**	b) _____/**1**
_____/**3**	c) _____/**1**
_____/**3**	d)_____/**1**
_____ /**5**	e) _____/**1**
Subtotal	**Subtotal**
_____/**15**	_____/**5**

TOTAL Score: _____/20

a) Description:

a. In the precondition, I have everything I use in all the other parts being initialized and set all the lights to be off. I have my CID displaying on HEX2-HEX0 and HEX3 being blank.
b. In part one, I used sw[3:0] and HEX[3:0]. HEX[3:2] displays the decimal number of sw[3:0] represented as binary. HEX1 is blank as it is used as a space and HEX 0 displays the Hex number of sw[3:0].
c. In part two, I used sw[4:0] and HEX[3:0]. Sw[4:3] represented the first operand in binary and sw[2:1] as the second operand in binary and sw0 is the operator selector, 0 for addition and 1 for multiplication. HEX3 displays the decimal value of the first operand and HEX2 displays the decimal value of the second operand. HEX1 is blank to represent a space and HEX0 is the decimal value of the result.
d. In part three, I used key[2], sw[1:0] and HEX2. Key[2] is used as the counter, sw0 is used for resetting the counter back to zero and sw1 causes the counter to increment if it's down and decrements if the switch is up. HEX2 displays the counter in hex and all other HEX's are blank.
e. In part four, I used sw0, HEX[3:0] and ledg0. Sw0 is used for resetting the clock back to zero, HEX[3:0] displays the clock in modulo-3 operation and ledg0 starts blinking every second with 50% duty cycle.
f. In part five, I used sw0, ledr[9:0] and HEX[3:0]. Ledr[9:0] starting from ledr0 lights one led at a time moving back and forth with a duration of a second for the round trip. HEX[3:0] displays a moving message that repeats and is synchronized with the movement of the lights. The message moves one letter to the left every time ledr9 is on. And sw0 is used to pause if the switch is up and resumes if the switch is down.

b) Flowchart



c) Verilog Code

```
`define BLANK 7'b1111111
`define ZERO 7'b1000000
`define ONE 7'b1111001
`define TWO 7'b0100100
`define THREE 7'b0110000
`define FOUR 7'b0011001
`define FIVE 7'b0010010
`define SIX 7'b0000010
`define SEVEN 7'b1111000
`define EIGHT 7'b0000000
`define NINE 7'b0011000
`define A 7'b0001000
`define b 7'b0000011
`define C 7'b1000110
`define d 7'b0100001
`define E 7'b0000110
`define F 7'b0001110
`define H 7'b0001001
`define L 7'b1000111

module L2C580                           // where 580 = CID
(
        input [9:0]sw,                  // ten up-down switches, SW9 - SW0
        input [3:0]key,                 // four pushbutton swithes, KEY3 - KEY0
        input clock,                    // 24MHz clock source on Altera DE1 board
        output reg [9:0]ledr,           // ten Red LEDs, LEDR9 - LEDR0
        output [7:0]ledg,     // eight Green LEDs, LEDG8 - LEDG0
```

```
        output reg[6:0]hex3,hex2,hex1,hex0    // four 7-segment, HEX3 - HEX0
);
integer counter;
integer cycle = 0;
integer cycle1 = 0;
integer real_time = 0;
integer real_time1 = 0;
integer real_time2 = 0;
integer real_time3 = 0;
integer dir = 0;
integer mes = 0;
assign gate = ~key[2] | sw[0] | ~sw[7];
reg light;
assign ledg[0] = light;
always @(posedge gate) begin
  if (sw[7] == 0) begin
        counter = 0;
       end
       if (sw[0] == 0) begin
                if (sw[1] == 0 && sw[7] == 1) begin
                 counter = counter + 1;
                 if (counter > 15) begin
                        counter = 0;
                 end
                end
                else if (sw[1] == 1 && sw[7] == 1) begin
                 counter = counter - 1;
                 if (counter < 0) begin
                        counter = 15;
                 end
                end
       end
       else begin
                counter = 0;
       end
end
always @(posedge clock) begin
       if (sw[9:5]==5'b00000) begin // all sw are in DOWN position
        //Initial state (No Part is selected)
        hex3 = `BLANK;
        hex2 = `FIVE;
        hex1 = `EIGHT;
        hex0 = `ZERO;
        cycle = 0;
        light = 0;
        ledr[9:0] = 0;
        real_time = 0;
        real_time1 = 0;
        real_time2 = 0;
        real_time3 = 0;
        mes = 0;
       end
       else if (sw[9:5]==5'b10000) begin // only sw[9] is in UP position
        //Only Part1 is selected
        hex1 = `BLANK;
        if (sw[3:0] == 4'b0000) begin
                hex3 = `ZERO;
                hex2 = `ZERO;
                hex0 = `ZERO;
        end
        else if (sw[3:0] == 4'b0001) begin
                hex3 = `ZERO;
                hex2 = `ONE;
                hex0 = `ONE;
        end
        else if (sw[3:0] == 4'b0010) begin
                hex3 = `ZERO;
                hex2 = `TWO;
                hex0 = `TWO;
        end
```

```
 else if (sw[3:0] == 4'b0011) begin
            hex3 = `ZERO;
            hex2 = `THREE;
            hex0 = `THREE;
 end
 else if (sw[3:0] == 4'b0100) begin
            hex3 = `ZERO;
            hex2 = `FOUR;
            hex0 = `FOUR;
 end
 else if (sw[3:0] == 4'b0101) begin
            hex3 = `ZERO;
            hex2 = `FIVE;
            hex0 = `FIVE;
 end
 else if (sw[3:0] == 4'b0110) begin
            hex3 = `ZERO;
            hex2 = `SIX;
            hex0 = `SIX;
 end
 else if (sw[3:0] == 4'b0111) begin
            hex3 = `ZERO;
            hex2 = `SEVEN;
            hex0 = `SEVEN;
 end
 else if (sw[3:0] == 4'b1000) begin
            hex3 = `ZERO;
            hex2 = `EIGHT;
            hex0 = `EIGHT;
 end
 else if (sw[3:0] == 4'b1001) begin
            hex3 = `ZERO;
            hex2 = `NINE;
            hex0 = `NINE;
 end
 else if (sw[3:0] == 4'b1010) begin
            hex3 = `ONE;
            hex2 = `ZERO;
            hex0 = `A;
 end
 else if (sw[3:0] == 4'b1011) begin
            hex3 = `ONE;
            hex2 = `ONE;
            hex0 = `b;
 end
 else if (sw[3:0] == 4'b1100) begin
            hex3 = `ONE;
            hex2 = `TWO;
            hex0 = `C;
 end
 else if (sw[3:0] == 4'b1101) begin
            hex3 = `ONE;
            hex2 = `THREE;
            hex0 = `d;
 end
 else if (sw[3:0] == 4'b1110) begin
            hex3 = `ONE;
            hex2 = `FOUR;
            hex0 = `E;
 end
 else if (sw[3:0] == 4'b1111) begin
            hex3 = `ONE;
            hex2 = `FIVE;
            hex0 = `F;
 end
end
else if (sw[9:5]==5'b01000) begin // only sw[8] is in UP position
 //Only Part2 is selected
 hex1 = `BLANK;
 if (sw[4:0] == 5'b00000) begin
```

```
            hex3 = `ZERO;
            hex2 = `ZERO;
            hex0 = `ZERO;
end
else if (sw[4:0] == 5'b00010) begin
            hex3 = `ZERO;
            hex2 = `ONE;
            hex0 = `ONE;
end
else if (sw[4:0] == 5'b00100) begin
            hex3 = `ZERO;
            hex2 = `TWO;
            hex0 = `TWO;
end
else if (sw[4:0] == 5'b00110) begin
            hex3 = `ZERO;
            hex2 = `THREE;
            hex0 = `THREE;
end
else if (sw[4:0] == 5'b01000) begin
            hex3 = `ONE;
            hex2 = `ZERO;
            hex0 = `ONE;
end
else if (sw[4:0] == 5'b01010) begin
            hex3 = `ONE;
            hex2 = `ONE;
            hex0 = `TWO;
end
else if (sw[4:0] == 5'b01100) begin
            hex3 = `ONE;
            hex2 = `TWO;
            hex0 = `THREE;
end
else if (sw[4:0] == 5'b01110) begin
            hex3 = `ONE;
            hex2 = `THREE;
            hex0 = `FOUR;
end
else if (sw[4:0] == 5'b10000) begin
            hex3 = `TWO;
            hex2 = `ZERO;
            hex0 = `TWO;
end
else if (sw[4:0] == 5'b10010) begin
            hex3 = `TWO;
            hex2 = `ONE;
            hex0 = `THREE;
end
else if (sw[4:0] == 5'b10100) begin
            hex3 = `TWO;
            hex2 = `TWO;
            hex0 = `FOUR;
end
else if (sw[4:0] == 5'b10110) begin
            hex3 = `TWO;
            hex2 = `THREE;
            hex0 = `FIVE;
end
else if (sw[4:0] == 5'b11000) begin
            hex3 = `THREE;
            hex2 = `ZERO;
            hex0 = `THREE;
end
else if (sw[4:0] == 5'b11010) begin
            hex3 = `THREE;
            hex2 = `ONE;
            hex0 = `FOUR;
end
else if (sw[4:0] == 5'b11100) begin
```

```
            hex3 = `THREE;
            hex2 = `TWO;
            hex0 = `FIVE;
end
else if (sw[4:0] == 5'b11110) begin
            hex3 = `THREE;
            hex2 = `THREE;
            hex0 = `SIX;
end
else if (sw[4:0] == 5'b00001) begin
            hex3 = `ZERO;
            hex2 = `ZERO;
            hex0 = `ZERO;
end
else if (sw[4:0] == 5'b00011) begin
            hex3 = `ZERO;
            hex2 = `ONE;
            hex0 = `ZERO;
end
else if (sw[4:0] == 5'b00101) begin
            hex3 = `ZERO;
            hex2 = `TWO;
            hex0 = `ZERO;
end
else if (sw[4:0] == 5'b00111) begin
            hex3 = `ZERO;
            hex2 = `THREE;
            hex0 = `ZERO;
end
else if (sw[4:0] == 5'b01001) begin
            hex3 = `ONE;
            hex2 = `ZERO;
            hex0 = `ZERO;
end
else if (sw[4:0] == 5'b01011) begin
            hex3 = `ONE;
            hex2 = `ONE;
            hex0 = `ONE;
end
else if (sw[4:0] == 5'b01101) begin
            hex3 = `ONE;
            hex2 = `TWO;
            hex0 = `TWO;
end
else if (sw[4:0] == 5'b01111) begin
            hex3 = `ONE;
            hex2 = `THREE;
            hex0 = `THREE;
end
else if (sw[4:0] == 5'b10001) begin
            hex3 = `TWO;
            hex2 = `ZERO;
            hex0 = `ZERO;
end
else if (sw[4:0] == 5'b10011) begin
            hex3 = `TWO;
            hex2 = `ONE;
            hex0 = `TWO;
end
else if (sw[4:0] == 5'b10101) begin
            hex3 = `TWO;
            hex2 = `TWO;
            hex0 = `FOUR;
end
else if (sw[4:0] == 5'b10111) begin
            hex3 = `TWO;
            hex2 = `THREE;
            hex0 = `SIX;
end
else if (sw[4:0] == 5'b11001) begin
```

```
            hex3 = `THREE;
            hex2 = `ZERO;
            hex0 = `ZERO;
 end
 else if (sw[4:0] == 5'b11011) begin
            hex3 = `THREE;
            hex2 = `ONE;
            hex0 = `THREE;
 end
 else if (sw[4:0] == 5'b11101) begin
            hex3 = `THREE;
            hex2 = `TWO;
            hex0 = `SIX;
 end
 else if (sw[4:0] == 5'b11111) begin
            hex3 = `THREE;
            hex2 = `THREE;
            hex0 = `NINE;
 end

end
else if (sw[9:5]==5'b00100) begin // only sw[7] is in UP position
 //Only Part3 is selected
 hex3 = `BLANK;
 hex1 = `BLANK;
 hex0 = `BLANK;
 if (counter == 0) begin
   hex2 = `ZERO;
 end
 else if (counter == 1) begin
   hex2 = `ONE;
 end
 else if (counter == 2) begin
   hex2 = `TWO;
 end
 else if (counter == 3) begin
   hex2 = `THREE;
 end
 else if (counter == 4) begin
   hex2 = `FOUR;
 end
 else if (counter == 5) begin
   hex2 = `FIVE;
 end
 else if (counter == 6) begin
   hex2 = `SIX;
 end
 else if (counter == 7) begin
   hex2 = `SEVEN;
 end
 else if (counter == 8) begin
   hex2 = `EIGHT;
 end
 else if (counter == 9) begin
   hex2 = `NINE;
 end
 else if (counter == 10) begin
   hex2 = `A;
 end
 else if (counter == 11) begin
   hex2 = `b;
 end
 else if (counter == 12) begin
   hex2 = `C;
 end
 else if (counter == 13) begin
   hex2 = `d;
 end
 else if (counter == 14) begin
   hex2 = `E;
```

```
 end
 else if (counter == 15) begin
   hex2 = `F;
 end
end
else if (sw[9:5]==5'b00010) begin // only sw[6] is in UP position
 //Only Part4 is selected
 cycle = cycle + 1;
 if (cycle == 24000000) begin
              real_time = real_time + 1;
              cycle = 0;
 end
 if (cycle == 0) begin
   light = 0;
 end
 else if (cycle == 12000000) begin
   light = 1;
 end
 if (real_time == 3) begin
   real_time = 0;
   real_time1 = real_time1 + 1;
 end
 if (real_time1 == 3) begin
   real_time1 = 0;
   real_time2 = real_time2 + 1;
 end
 if (real_time2 == 3) begin
   real_time2 = 0;
   real_time3 = real_time3 + 1;
 end
 if (real_time3 == 3) begin
   real_time3 = 0;
 end
 if (real_time % 3 == 0) begin
   hex0 = `ZERO;
 end
 else if (real_time % 3 == 1) begin
   hex0 = `ONE;
 end
 else if (real_time % 3 == 2) begin
   hex0 = `TWO;
 end
 if (real_time1 % 3 == 0) begin
   hex1 = `ZERO;
 end
 else if (real_time1 % 3 == 1) begin
   hex1 = `ONE;
 end
 else if (real_time1 % 3 == 2) begin
   hex1 = `TWO;
 end
 if (real_time2 % 3 == 0) begin
   hex2 = `ZERO;
 end
 else if (real_time2 % 3 == 1) begin
   hex2 = `ONE;
 end
 else if (real_time2 % 3 == 2) begin
   hex2 = `TWO;
 end
 if (real_time3 % 3 == 0) begin
   hex3 = `ZERO;
 end
 else if (real_time3 % 3 == 1) begin
   hex3 = `ONE;
 end
 else if (real_time3 % 3 == 2) begin
   hex3 = `TWO;
 end
 if (sw[0] == 1) begin
```

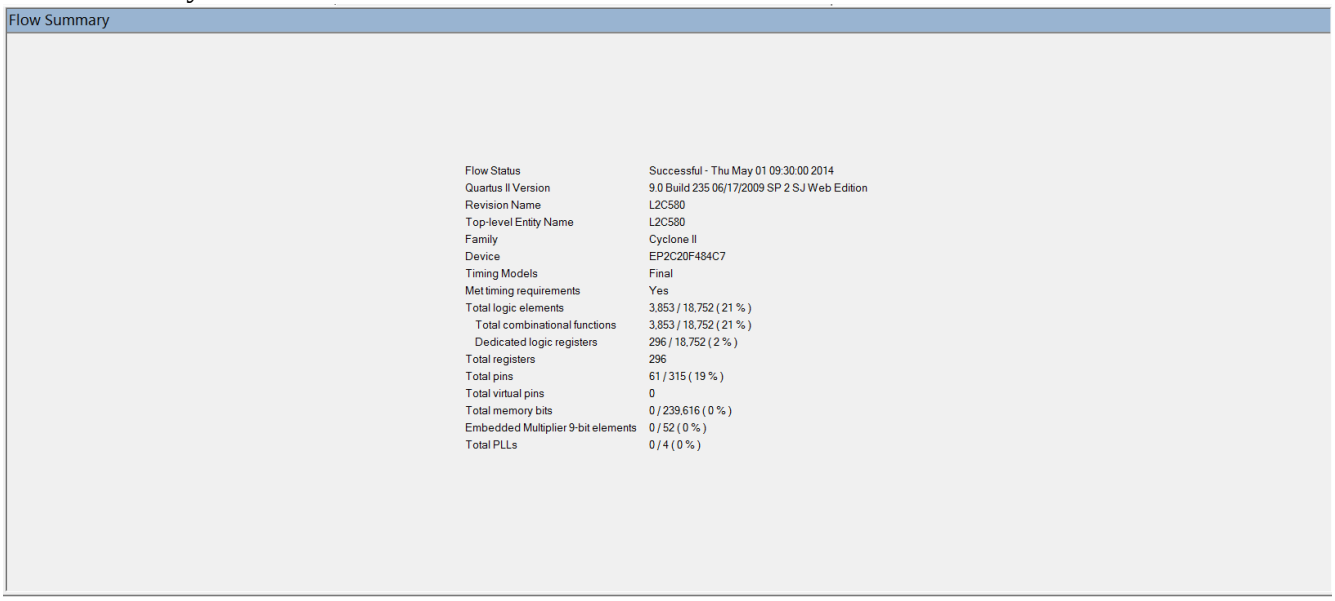
```
   real_time = 0;
   real_time1 = 0;
   real_time2 = 0;
   real_time3 = 0;
   cycle = 0;
   light = 0;
  end
 end
 else if (sw[9:5]==5'b00001) begin // only sw[5] is in UP position
  //Only Part5 is selected
  if (sw[0] == 0) begin
     if (mes % 19 == 0) begin
                          hex0 = `BLANK;
                          hex1 = `BLANK;
                          hex2 = `BLANK;
                          hex3 = `BLANK;


               end
     else if (mes % 19 == 1) begin
       hex0 = `H;

     end
     else if (mes % 19 == 2) begin
       hex0 = `E;
       hex1 = `H;

     end
     else if (mes % 19 == 3) begin
       hex0 = `L;
       hex1 = `E;
       hex2 = `H;

     end
     else if (mes % 19 == 4) begin
       hex0 = `L;
       hex1 = `L;
       hex2 = `E;
       hex3 = `H;

     end
     else if (mes % 19 == 5) begin
       hex0 = `ZERO;
       hex1 = `L;
       hex2 = `L;
       hex3 = `E;

     end
     else if (mes % 19 == 6) begin
       hex0 = `BLANK;
       hex1 = `ZERO;
       hex2 = `L;
       hex3 = `L;

     end
     else if (mes % 19 == 7) begin
       hex0 = `BLANK;
       hex1 = `BLANK;
       hex2 = `ZERO;
       hex3 = `L;

     end
     else if (mes % 19 == 8) begin
       hex0 = `C;
       hex1 = `BLANK;
       hex2 = `BLANK;
       hex3 = `ZERO;

     end
     else if (mes % 19 == 9) begin
       hex0 = `ONE;
```

```
  hex1 = `C;
  hex2 = `BLANK;
  hex3 = `BLANK;

end
else if (mes % 19 == 10) begin
  hex0 = `d;
  hex1 = `ONE;
  hex2 = `C;
  hex3 = `BLANK;

end
else if (mes % 19 == 11) begin
  hex0 = `BLANK;
  hex1 = `d;
  hex2 = `ONE;
  hex3 = `C;

end
else if (mes % 19 == 12) begin
  hex0 = `FIVE;
  hex1 = `BLANK;
  hex2 = `d;
  hex3 = `ONE;

end
else if (mes % 19 == 13) begin
  hex0 = `EIGHT;
  hex1 = `FIVE;
  hex2 = `BLANK;
  hex3 = `d;

end
else if (mes % 19 == 14) begin
  hex0 = `ZERO;
  hex1 = `EIGHT;
  hex2 = `FIVE;
  hex3 = `BLANK;

end
else if (mes % 19 == 15) begin
  hex0 = `BLANK;
  hex1 = `ZERO;
  hex2 = `EIGHT;
  hex3 = `FIVE;

end
else if (mes % 19 == 16) begin
  hex0 = `BLANK;
  hex1 = `BLANK;
  hex2 = `ZERO;
  hex3 = `EIGHT;

end
else if (mes % 19 == 17) begin
  hex0 = `BLANK;
  hex1 = `BLANK;
  hex2 = `BLANK;
  hex3 = `ZERO;

end
else if (mes % 19 == 18) begin
  hex0 = `BLANK;
  hex1 = `BLANK;
  hex2 = `BLANK;
  hex3 = `BLANK;

end
        cycle1 = cycle1 + 1;
```

```
        if(ledr[9:0] == 0) begin
  ledr[0] = 1;
end
        if (cycle1 % (24000000/18) == 0 && (ledr[0] == 1)) begin
                ledr[1] = 1;
                ledr[0] = 0;
                dir = 0;
        end
        else if (cycle1 % (24000000/18) == 0 && ledr[1] == 1) begin
  if (dir == 0) begin
                        ledr[2] = 1;
                        ledr[1] = 0;
                end
                else begin
     ledr[0] = 1;
     ledr[1] = 0;
  end
end
else if (cycle1 % (24000000/18) == 0 && ledr[2] == 1) begin
           if (dir == 0) begin
                        ledr[3] = 1;
                        ledr[2] = 0;
                end
                else begin
              ledr[1] = 1;
              ledr[2] = 0;
           end
        end
        else if (cycle1 % (24000000/18) == 0 && ledr[3] == 1) begin
  if (dir == 0) begin
                        ledr[4] = 1;
                        ledr[3] = 0;
                end
                else begin
     ledr[2] = 1;
     ledr[3] = 0;
  end
end
else if (cycle1 % (24000000/18) == 0 && ledr[4] == 1) begin
           if (dir == 0) begin
                        ledr[5] = 1;
                        ledr[4] = 0;
                end
                else begin
              ledr[3] = 1;
              ledr[4] = 0;
           end
        end
        else if (cycle1 % (24000000/18) == 0 && ledr[5] == 1) begin
  if (dir == 0) begin
                        ledr[6] = 1;
                        ledr[5] = 0;
                end
                else begin
                        ledr[4] = 1;
                        ledr[5] = 0;
                end
end
else if (cycle1 % (24000000/18) == 0 && ledr[6] == 1) begin
           if (dir == 0) begin
                        ledr[7] = 1;
                        ledr[6] = 0;
                end
                else begin
                        ledr[5] = 1;
                        ledr[6] = 0;
                end
        end
        else if (cycle1 % (24000000/18) == 0 && ledr[7] == 1) begin
  if (dir == 0) begin
```

```
                                        ledr[8] = 1;
                                        ledr[7] = 0;
                                end
                                else begin
                                        ledr[6] = 1;
                                        ledr[7] = 0;
                                end
                        end
                        else if (cycle1 % (24000000/18) == 0 && ledr[8] == 1) begin
                                if (dir == 0) begin
                                        ledr[9] = 1;
                                        ledr[8] = 0;
                                        mes = mes + 1;
                                end
                                else begin
                                        ledr[7] = 1;
                                        ledr[8] = 0;
                                end
                        end
                        else if (cycle1 % (24000000/18) == 0 && ledr[9] == 1) begin
                                ledr[8] = 1;
                                ledr[9] = 0;
                                dir = 1;
                        end
                    end
                end
            end
 end
endmodule
```

d) Flow Summary



e) Timing Analyzer Summary

Timing Analyzer Summary

	Type	Slack	Required Time	Actual Time	From	To	From Clock	To Clock	Failed Paths
1	Worst-case tsu	N/A	None	11.421 ns	sw[9]	hex2[2]~reg0	--	clock	0
2	Worst-case tco	N/A	None	9.730 ns	hex1[4]~reg0	hex1[4]	clock	--	0
3	Worst-case th	N/A	None	3.497 ns	sw[0]	counter[4]	--	sw[7]	0
4	Clock Setup: 'clock'	N/A	None	7.70 MHz (period = 129.854 ns)	cycle[0]	hex3[6]~reg0	clock	clock	0
5	Clock Setup: 'sw[7]'	N/A	None	124.47 MHz (period = 8.034 ns)	counter[2]	counter[16]	sw[7]	sw[7]	0
6	Clock Setup: 'key[2]'	N/A	None	124.47 MHz (period = 8.034 ns)	counter[2]	counter[16]	key[2]	key[2]	0
7	Clock Setup: 'sw[0]'	N/A	None	124.47 MHz (period = 8.034 ns)	counter[2]	counter[16]	sw[0]	sw[0]	0
8	Total number of failed paths								0