Voting Machine Project

1) Button Control Validity

```
module button_control_VALIDITY(
       input clk, reset, button,
       output reg valid_vote);

//counter for valid_vote//
      reg [31:0] counter;
      always@(posedge clk)
       begin
        if(reset)
         counter <= 0;
        else
         begin
          if(button & counter < 11)
           counter <= counter + 1;
          else if(!button)
           counter <= 0;
       end
      end
```

```
//valid vote logic//
      always@(posedge clk)
       begin
        if(reset)
         valid_vote<=1'b0;
        else
         begin
          if(counter==10)
           valid_vote<=1'b1;
          else
           valid_vote<=1'b0;
         end
       end

endmodule
```

2) Vote Logger

```
module vote_logger(
  input clk, reset, mode, cand1_vote_valid, cand2_vote_valid, cand3_vote_valid, cand4_vote_valid,
  output reg [31:0] cand1_vote_rcvd, cand2_vote_rcvd, cand3_vote_rcvd, cand4_vote_rcvd);

 always@(posedge clk)
  begin
   if(reset)
    begin
     cand1_vote_rcvd<=0;
     cand2_vote_rcvd<=0;
     cand3_vote_rcvd<=0;
     cand4_vote_rcvd<=0;
    end
   else if(mode==0) begin
     if(cand1_vote_valid)
      cand1_vote_rcvd<=cand1_vote_rcvd+1;
     else if(cand2_vote_valid)
      cand2_vote_rcvd<=cand2_vote_rcvd+1;
     else if(cand3_vote_valid)
      cand3_vote_rcvd<=cand3_vote_rcvd+1;
     else if(cand4_vote_valid)
      cand4_vote_rcvd<=cand4_vote_rcvd+1;
    end
  end
endmodule
```


3) LED Control

```
module led_ctrl(
    input clk, reset, mode, valid_vote_casted,
    input [7:0] cand1_vote, cand2_vote, cand3_vote, cand4_vote,
    input cand1_button_press, cand2_button_press, cand3_button_press, cand4_button_press,
    output reg [7:0] LEDs);

    reg [31:0] counter;

    always@(posedge clk)
    begin
     if(reset)
      counter<=0;
     else if(valid_vote_casted)
      counter<=counter+1;
     else if(counter!=0 & counter<10)
     counter<=counter+1;
     else
      counter<=0;
    end
```

```
    always@(posedge clk)
    begin
     if(reset)
      LEDs <= 0;
     else
      begin
       if(mode==0 & counter<10)
        LEDs <= 8'hFF;
       else if(mode==0) //voting mode
        LEDs <= 0;
       else if(mode==1) //result mode
        begin
         if(cand1_button_press)
          LEDs<=cand1_vote;
         else if(cand2_button_press)
          LEDs<=cand2_vote;
         else if(cand3_button_press)
          LEDs<=cand3_vote;
         else if(cand4_button_press)
          LEDs<=cand4_vote;
        end
      end
    end
endmodule
```


4) Top Module

```
module voting_machine(
    input clk, reset, mode, cand1_button, cand2_button, cand3_button, cand4_button,
    output [7:0] LEDs);

    wire valid_vote_1, valid_vote_2, valid_vote_3, valid_vote_4;
    wire [7:0] cand1_vote_rcvd, cand2_vote_rcvd, cand3_vote_rcvd, cand4_vote_rcvd;
    wire any_valid_vote;

    button_control_VALIDITY bc1(
         .clk(clk), .reset(reset),
         .button(cand1_button),
         .valid_vote(valid_vote_1)
         );

    button_control_VALIDITY bc2(
         .clk(clk), .reset(reset),
         .button(cand2_button),
         .valid_vote(valid_vote_2)
         );

    button_control_VALIDITY bc3(
         .clk(clk), .reset(reset),
         .button(cand3_button),
         .valid_vote(valid_vote_3)
         );
```

```
    button_control_VALIDITY bc4(
         .clk(clk), .reset(reset),
         .button(cand4_button),
         .valid_vote(valid_vote_4)
         );

    assign any_valid_vote = valid_vote_1 | valid_vote_2 | valid_vote_3 | valid_vote_4;


    vote_logger VL(
         .clk(clk), .reset(reset), .mode(mode),
         .cand1_vote_valid(valid_vote_1),
         .cand2_vote_valid(valid_vote_2),
         .cand3_vote_valid(valid_vote_3),
         .cand4_vote_valid(valid_vote_4),
         .cand1_vote_rcvd(cand1_vote_rcvd),
         .cand2_vote_rcvd(cand2_vote_rcvd),
         .cand3_vote_rcvd(cand3_vote_rcvd),
         .cand4_vote_rcvd(cand4_vote_rcvd)
         );
```

```
    led_ctrl LC(
    .clk(clk), .reset(reset), .mode(mode),
    .valid_vote_casted(any_valid_vote),
    .cand1_vote(cand1_vote_rcvd),
    .cand2_vote(cand2_vote_rcvd),
    .cand3_vote(cand3_vote_rcvd),
    .cand4_vote(cand4_vote_rcvd),
    .cand1_button_press(valid_vote_1),
    .cand2_button_press(valid_vote_2),
    .cand3_button_press(valid_vote_3),
    .cand4_button_press(valid_vote_4),
    .LEDs(LEDs)
    );
endmodule
```

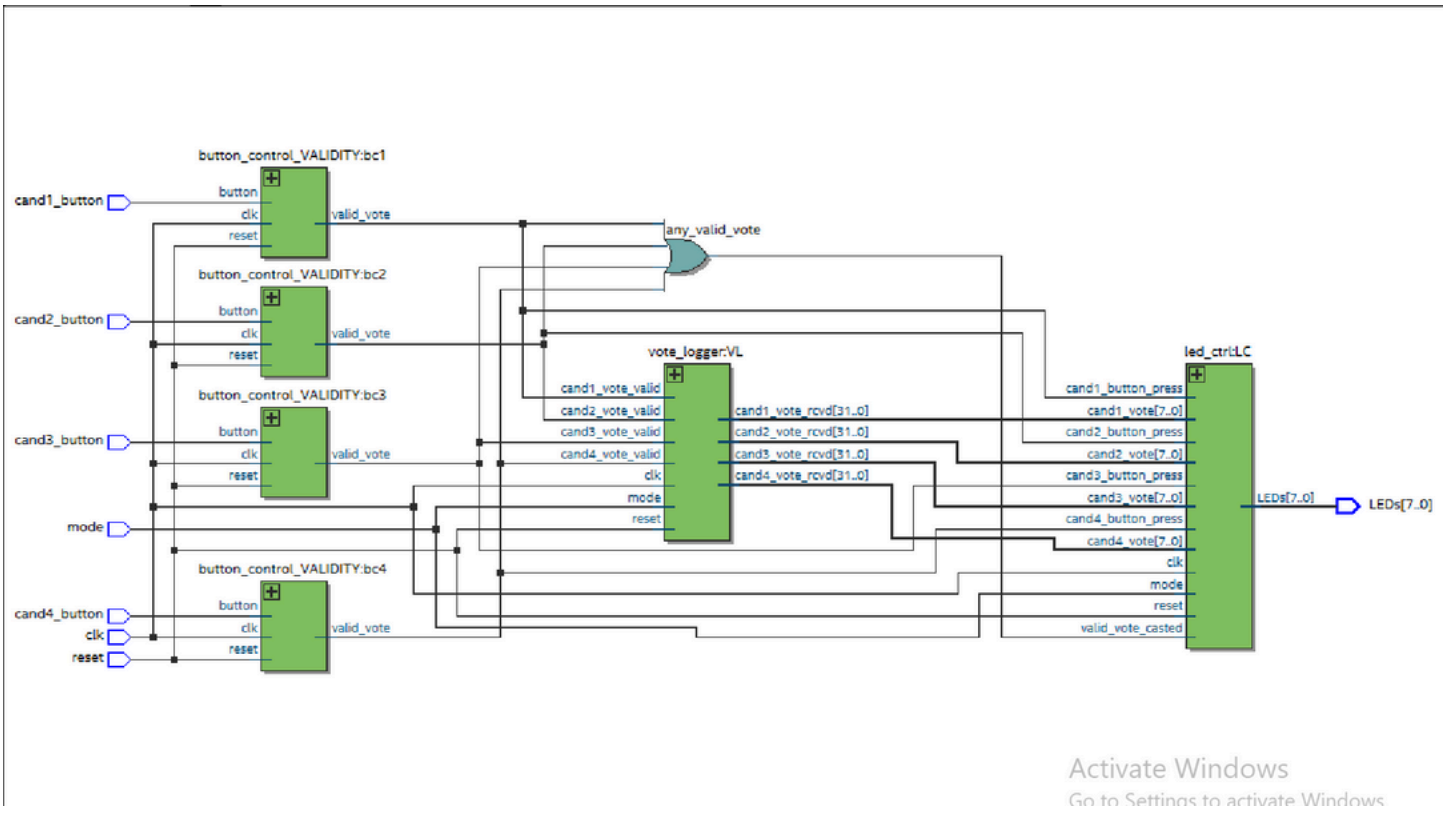
Testbench

```
module tb_voting_machine;

reg clk, reset, mode;
reg button1 ,button2, button3, button4;
wire [7:0] LEDs;

voting_machine DUT(.clk(clk), .reset(reset), .mode(mode),
                           .cand1_button(button1), .cand2_button(button2), .cand3_button(button3), .cand4_button(button4),
                           .LEDs(LEDs));


initial begin
clk=0;
forever #5 clk=~clk;
end

initial begin
    // Initialize Inputs
    reset = 1; mode = 0; button1 = 0; button2 = 0; button3 = 0; button4 = 0;
    // Wait 100 ns for global reset to finish
    #100;

    // Add stimulus here
```

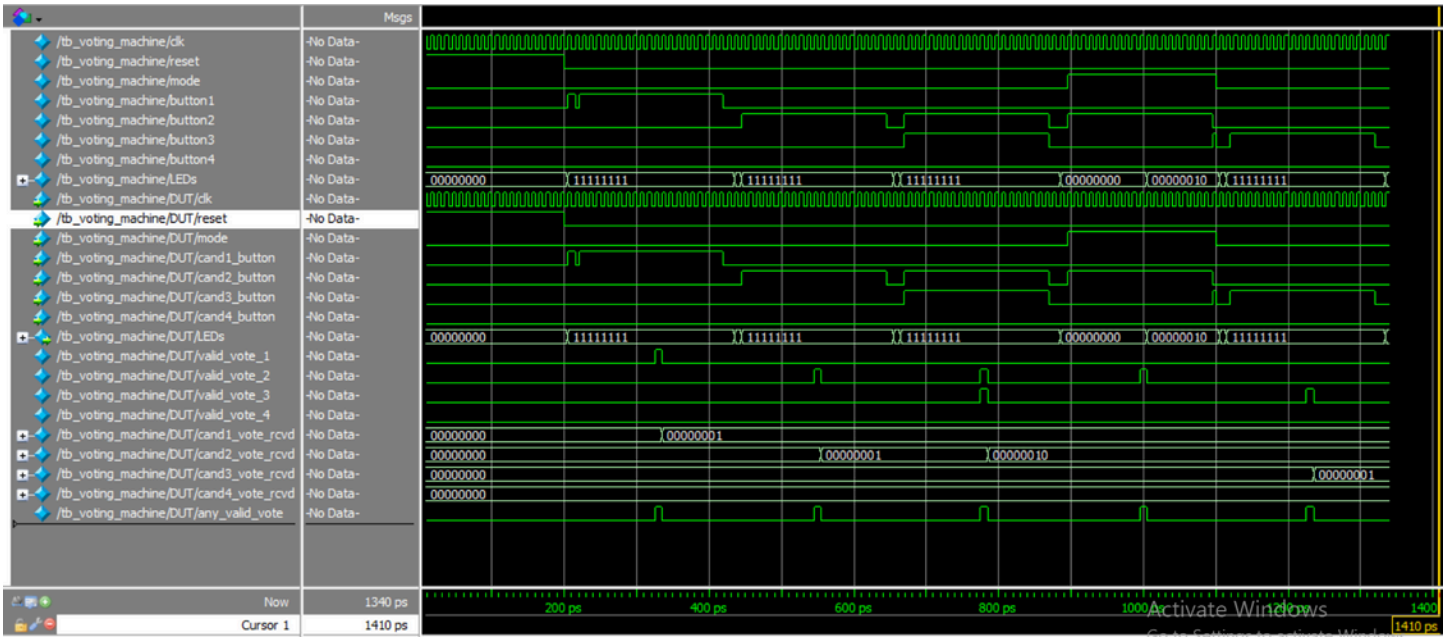
```
    #5 reset = 0; mode = 0; button1 = 1; button2 = 0; button3 = 0; button4 = 0;
    #10 reset = 0; mode = 0; button1 = 0; button2 = 0; button3 = 0; button4 = 0;
    #5 reset = 0; mode = 0; button1 = 1; button2 = 0; button3 = 0; button4 = 0;
    #200 reset = 0; mode = 0; button1 = 0; button2 = 0; button3 = 0; button4 = 0;
    #5 reset = 0; mode = 0; button1 = 0; button2 = 0; button3 = 0; button4 = 0;
    #10 reset = 0; mode = 0; button1 = 0; button2 = 0; button3 = 0; button4 = 0;
    #5 reset = 0; mode = 0; button1 = 0; button2 = 0; button3 = 0; button4 = 0;

    #5 reset = 0; mode = 0; button1 = 0; button2 = 1; button3 = 0; button4 = 0;
    #200 reset = 0; mode = 0; button1 = 0; button2 = 0; button3 = 0; button4 = 0;
    #5 reset = 0; mode = 0; button1 = 0; button2 = 0; button3 = 0; button4 = 0;
    #10 reset = 0; mode = 0; button1 = 0; button2 = 0; button3 = 0; button4 = 0;
    #5 reset = 0; mode = 0; button1 = 0; button2 = 0; button3 = 0; button4 = 0;

    #5 reset = 0; mode = 0; button1 = 0; button2 = 1; button3 = 1; button4 = 0;
    #200 reset = 0; mode = 0; button1 = 0; button2 = 0; button3 = 0; button4 = 0;
    #5 reset = 0; mode = 0; button1 = 0; button2 = 0; button3 = 0; button4 = 0;
    #10 reset = 0; mode = 0; button1 = 0; button2 = 0; button3 = 0; button4 = 0;
    #5 reset = 0; mode = 0; button1 = 0; button2 = 0; button3 = 0; button4 = 0;

    #5 reset = 0; mode = 1; button1 = 0; button2 = 1; button3 = 0; button4 = 0;
    #200 reset = 0; mode = 1; button1 = 0; button2 = 0; button3 = 1; button4 = 0;
    #5 reset = 0; mode = 0; button1 = 0; button2 = 0; button3 = 0; button4 = 0;
    #10 reset = 0; mode = 0; button1 = 0; button2 = 0; button3 = 0; button4 = 0;
    #5 reset = 0; mode = 0; button1 = 0; button2 = 0; button3 = 0; button4 = 0;
```

```
    #5 reset = 0; mode = 0; button1 = 0; button2 = 0; button3 = 1; button4 = 0;
    #200 reset = 0; mode = 0; button1 = 0; button2 = 0; button3 = 0; button4 = 0;
    #5 reset = 0; mode = 0; button1 = 0; button2 = 0; button3 = 0; button4 = 0;
    #10 reset = 0; mode = 0; button1 = 0; button2 = 0; button3 = 0; button4 = 0;
    #5 reset = 0; mode = 0; button1 = 0; button2 = 0; button3 = 0; button4 = 0;

$finish;
end
 initial
 $monitor($time, "mode = %b, button1 = %b, button2 = %b, button3 = %b, button4 = %b, led = %d",
          mode, button1, button2, button3, button4, LEDs);
endmodule
```

RTL Viewer



WAVEFORM


Msgs
/tb_voting_machine/clk
/tb_voting_machine/reset
/tb_voting_machine/mode
/tb_voting_machine/button1
/tb_voting_machine/button2
/tb_voting_machine/button3
/tb_voting_machine/button4
/tb_voting_machine/LEDs
/tb_voting_machine/DUT/clk
/tb_voting_machine/DUT/reset
/tb_voting_machine/DUT/mode
/tb_voting_machine/DUT/cand1_button
/tb_voting_machine/DUT/cand2_button
/tb_voting_machine/DUT/cand3_button
/tb_voting_machine/DUT/cand4_button
/tb_voting_machine/DUT/LEDs
/tb_voting_machine/DUT/valid_vote_1
/tb_voting_machine/DUT/valid_vote_2
/tb_voting_machine/DUT/valid_vote_3
/tb_voting_machine/DUT/valid_vote_4
/tb_voting_machine/DUT/cand1_vote_rcvd
/tb_voting_machine/DUT/cand2_vote_rcvd
/tb_voting_machine/DUT/cand3_vote_rcvd
/tb_voting_machine/DUT/cand4_vote_rcvd
/tb_voting_machine/DUT/any_valid_vote
-No Data-
00000000
11111111
00000010
00000001
Now
1340 ps
Cursor 1
1410 ps
200 ps
400 ps
600 ps
800 ps
1000
1400
Activate Windows