```
module lock(din,lockopen,disablestate,idlestate,clk,reset,data_valid,key,lockkey);      //inputs are data_valid,din(key),clk,reset
input [3:0]din;
input data_valid,clk,reset,lockkey;
output lockopen,disablestate,idlestate;
reg lockopen,disablestate,idlestate;
reg [15:0]key;                                                                          //reg key to display whole key
output [15:0]key;
parameter  m0=1'b0,m1=1'b1,disabled=5'b00000, normal=5'b00001, s0=5'b00010, s1=5'b00011, s2=5'b00100, s3=5'b00101,
        s4=5'b00110, s5=5'b00111, s6=5'b01000, s7=5'b01001, s8=5'b01010,s9=5'b01011, s10=5'b01100, df1=5'b01101,
        df2=5'b01110, df3=5'b01111,s11=5'b10000;                                        //declaration of parameters for states in FSM
reg[4:0] cs,ns;
reg nss,css;                        // x-output of Lock FSM combinational block used for making count 0 in sequential block
reg datavalid_p,x;                                                                      //reg datavalid_p for ouput of level to pulse converter
reg [3:0] count;                                                                        //count to monitor the three failed attempts
always @ (posedge clk or negedge reset)
begin
if(~reset)
                key<=16'h0;
else            if(data_valid==1'b1)                                                    //giving serial input and storing in registers
                begin
                key[15:12]<=key[11:8];
                key[11:8]<=key[7:4];
                key[7:4]<=key[3:0];
                key[3:0]<=din;
        end
end

always @(posedge clk or negedge reset)                                                  //FSM to convert level to pulse: Sequential block
begin
if(~reset)
                css<=m0;
else
                css<=nss;
end

always @ (*)                                                                            //Combinational Block for level to pulse converter
begin
case(css)
        m0:
                if(data_valid==0)
                begin
                        nss=m0;
                        datavalid_p=1'b0;
                end
                else
                begin
                        nss=m1;
                        datavalid_p=1'b1;
                end
        m1:
                if(data_valid==0)
                begin
                        nss=m0;
                        datavalid_p=1'b0;
                end
                else
                begin
                        nss=m1;
                        datavalid_p=1'b0;
```

```
		end
		endcase
		end

always @ (posedge clk  or negedge reset)                    //sequential block of lock FSM
begin
	if(~reset)
	begin
		cs<=normal;
	end
	else if(datavalid_p==1)
		begin
		cs<=ns;
		end
end


always @ (posedge clk  or negedge reset)                    //sequential block for counter
	increment
begin
	if(~reset | x==1)
	begin
		count<=4'b0000;
	end
	else if(datavalid_p==1)
		begin
		count<=count+1;
		end
end



always @ (*)                                                //combinational block of lock FSM
begin
	case(cs)
	disabled:

		if(din==8)
		begin
			ns=s0;
		end
		else
		begin
			ns=df1;
		end
	s0:
		if(din==0)
			begin
			ns=s1;
			end
		else
			begin
			ns=df2;
			end
	s1:
		if(din==8)
			begin
			ns=s2;
			end
```

```
        else
                begin
                ns=df3;
                end

df1:            ns=df2;
df2:            ns=df3;
df3:            ns=disabled;

s2:
        if(din==0)
                begin
                ns=normal;
                end
        else
                begin
                ns=disabled;
                end
normal:

        if (din==1)
                begin
                ns=s3;
                end
        else
                begin
                ns=s9;
                end
s3:
        if(din==3)
                begin
                ns=s4;
                end
        else
                begin
                ns=s7;
                end
s4:
        if(din==9)
                begin
                ns=s5;
                end
        else
                begin
                ns=s8;
                end
s5:
        if(din==5)
                begin
                ns=s6;
                end
        else
                begin
                ns=normal;
                end
s6:
        begin
        if(lockkey==1)
                begin
```

```
                ns=s11;
                end
        else
                begin
                ns=s6;
                end
        end

    s11:
                if(din==1)
                begin
                ns=s3;
                end
                else
                ns=s9;
    s9:
                begin
                ns=s7;
                end
    s7:         begin
                ns=s8;
                end
    s8:         begin
                ns=s10;
                end
    s10:        begin
        if (count==4'b1011 & din==8)
                begin
                ns=s0;
                end
        else if(count==4'b1011 & din!=8)
                ns=df1;
        else if(din==1)
                begin
                ns=s3;
                end
        else
                ns=s9;
                end
    default:  ns=normal;

endcase
end


always @ (*)                                                    //Combinational block of LOCK FSM
begin
case(cs)
    disabled:
                begin
                lockopen=1'b0;   disablestate=1'b1; idlestate=1'b0;
                end
    normal:  begin
                lockopen=1'b0;   disablestate=1'b0; idlestate=1'b1;x=1'b0;
                end
    s0:
                begin
                lockopen=1'b0;   disablestate=1'b1; idlestate=1'b0;
                end
```

```
        s1:             begin
                        lockopen=1'b0;   disablestate=1'b1; idlestate=1'b0;
                        end
        s2:             begin
                        lockopen=1'b0;   disablestate=1'b1; idlestate=1'b0;
                        end
        s3:             begin
                        lockopen=1'b0;   disablestate=1'b0; idlestate=1'b0;x=1'b0;
                        end
        s4:             begin
                        lockopen=1'b0;   disablestate=1'b0; idlestate=1'b0;
                        end
        s5:             begin
                        lockopen=1'b0;   disablestate=1'b0; idlestate=1'b0;
                        end
        s6:
                        begin

                        lockopen=1'b1;   disablestate=1'b0; idlestate=1'b0;
                        end
        s11:
                        begin
                        lockopen=1'b0;   disablestate=1'b0; idlestate=1'b1;x=1;
                        end

        s7:             begin
                        lockopen=1'b0;   disablestate=1'b0; idlestate=1'b0;
                        end
        s8:             begin
                        lockopen=1'b0;   disablestate=1'b0; idlestate=1'b0;
                        end
        s9:             begin
                        lockopen=1'b0;   disablestate=1'b0; idlestate=1'b0;x=0;
                        end
        s10:            if (count==4'b1011)
                        begin
                        lockopen=1'b0;   disablestate=1'b1; idlestate=1'b0;
                        end
                        else
                        begin
                        lockopen=1'b0;   disablestate=1'b0; idlestate=1'b0;
                        end
        df1:            begin
                        lockopen=1'b0;   disablestate=1'b1; idlestate=1'b0;
                        end
        df2:            begin
                        lockopen=1'b0;   disablestate=1'b1; idlestate=1'b0;
                        end
        df3:            begin
                        lockopen=1'b0;   disablestate=1'b1; idlestate=1'b0;
                        end
        default:  begin
                        lockopen=1'b0;   disablestate=1'b0; idlestate=1'b1;
                        end
endcase
end
endmodule
```

```
`include "lock.v"
module lock_tb;

reg    [3:0] din;
reg    data_valid,clk,reset,lockkey;
wire   lockopen,idlestate,disablestate;
wire   [15:0]key;

initial
                $vcdpluson;

initial
      $monitor($time, "\t reset=%b \t din=%h \t data_valid=%b \t idlestate=%b \t disablestate=%b \t lockopen=%b key=%h
      lock=%b",reset,din[3:0],data_valid,idlestate,disablestate,lockopen,key,lockkey);

      lock uut(din,lockopen,disablestate,idlestate,clk,reset,data_valid,key,lockkey);

initial
                clk=0;
```

```
                always #5 clk=~clk;


initial
begin
                    first;
                #20 second;
                #20 third;
                #20 masterreset;
                #20 wrongmaster;
                #20 globalreset;
                #20 lockkeyinput;
end


task first;
begin
                $display("%d,\t Opening the lock on the first attempt",$time);
                   reset=0; din=0; data_valid=1;lockkey=0;
                #10 reset=1; din=0; data_valid=0;
                #10 din=1;data_valid=1;
                #10 din=0;data_valid=0;
                #10 din=3;data_valid=1;
                #10 din=0;data_valid=0;
                #10 din=9;data_valid=1;
                #10 din=0;data_valid=0;
                #10 din=5;data_valid=1;
                #10 din=0;data_valid=0;
                $display("%d, \t 1395 entered and lock is opened",$time);
                #10 din=9;data_valid=1;
                #10 din=0;data_valid=0;
                #10 lockkey=1;data_valid=1;
                #10 din=0;data_valid=0;
end
endtask

task second;
begin
                 $display("%d,\t Opening the lock on the second attempt ",$time);
                    din=1; data_valid=1;lockkey=0;
                #10 din=0; data_valid=0;
                #10 din=2; data_valid=1;
                #10 din=0; data_valid=0;
                #10 din=1; data_valid=1;
                #10 din=0; data_valid=0;
                #10 din=2; data_valid=1;
                #10 din=0; data_valid=0;
                $display("%d, \t 1st attempt failed",$time);
                #10 din=1; data_valid=1;
                #10 din=0; data_valid=0;
                #10 din=3; data_valid=1;
                #10 din=0; data_valid=0;
                #10 din=9; data_valid=1;
                #10 din=0; data_valid=0;
                #10 din=5; data_valid=1;
                #10 din=0; data_valid=0;
                $display("%d, \t 1395 entered and lock is opened",$time);
                #10 lockkey=1;data_valid=1;
                #10 din=0;data_valid=0;
```

```
end
endtask

task third;
begin
                $display("%d,\t Opening the lock on the third attempt",$time);
                   din=1; data_valid=1;lockkey=0;
                #10 din=0; data_valid=0;
                #10 din=2; data_valid=1;
                #10 din=0; data_valid=0;
                #10 din=1; data_valid=1;
                #10 din=0; data_valid=0;
                #10 din=2; data_valid=1;
                #10 din=0; data_valid=0;
                $display("%d, \t 1st attempt failed",$time);
                #10 din=1; data_valid=1;
                #10 din=0; data_valid=0;
                #10 din=2; data_valid=1;
                #10 din=0; data_valid=0;
                #10 din=1; data_valid=1;
                #10 din=0; data_valid=0;
                #10 din=2; data_valid=1;
                #10 din=0; data_valid=0;
                $display("%d, \t 2nd attempt failed",$time);
                #10 din=1; data_valid=1;
                #10 din=0; data_valid=0;
                #10 din=3; data_valid=1;
                #10 din=0; data_valid=0;
                #10 din=9; data_valid=1;
                #10 din=0; data_valid=0;
                #10 din=5; data_valid=1;
                #10 din=0; data_valid=0;
                $display("%d, \t 1395 entered and lock is opened",$time);
                #10 lockkey=1;data_valid=1;
                #10 din=0;data_valid=0;
end
endtask

task masterreset;
begin
                $display("%d, \t When Master Reset is needed",$time);
                   din=1; data_valid=1;lockkey=0;
                #10 din=0; data_valid=0;
                #10 din=2; data_valid=1;
                #10 din=0; data_valid=0;
                #10 din=1; data_valid=1;
                #10 din=0; data_valid=0;
                #10 din=2; data_valid=1;
                #10 din=0; data_valid=0;
                $display("%d, \t 1st attempt failed",$time);
                #10 din=1; data_valid=1;
                #10 din=0; data_valid=0;
                #10 din=2; data_valid=1;
                #10 din=0; data_valid=0;
                #10 din=3; data_valid=1;
                #10 din=0; data_valid=0;
                #10 din=4; data_valid=1;
                #10 din=0; data_valid=0;
```

```
		$display("%d, \t 2nd attempt failed",$time);
		#10 din=4; data_valid=1;
		#10 din=0; data_valid=0;
		#10 din=3; data_valid=1;
		#10 din=0; data_valid=0;
		#10 din=2; data_valid=1;
		#10 din=0; data_valid=0;
		#10 din=1; data_valid=1;
		#10 din=0; data_valid=0;
		$display("%d, \t 3rd attempt failed and lock enters disabled state",$time);
		#30 din=8; data_valid=1;
		#10 din=0; data_valid=0;
		#10 din=0; data_valid=1;
		#10 din=0; data_valid=0;
		#10 din=8; data_valid=1;
		#10 din=0; data_valid=0;
		#10 din=0; data_valid=1;
		#10 din=0; data_valid=0;
		$display("%d, \t Master reset used and lock came out of disabled",$time);
		#10 din=1; data_valid=1;
		#10 din=0; data_valid=0;
		#10 din=3; data_valid=1;
		#10 din=0; data_valid=0;
		#10 din=9; data_valid=1;
		#10 din=0; data_valid=0;
		#10 din=5; data_valid=1;
		#10 din=0; data_valid=0;
		$display("%d, \t 1395 entered and lock is opened",$time);
		#10 lockkey=1;data_valid=1;
		#10 din=0;data_valid=0;
		$display("%d, \t lock key pressed to lock the system",$time);
end
endtask

task wrongmaster;
begin
		$display("%d, \t When a wrong master key is used three times",$time);
		   din=1; data_valid=1;lockkey=0;
		#10 din=0; data_valid=0;
		#10 din=2; data_valid=1;
		#10 din=0; data_valid=0;
		#10 din=1; data_valid=1;
		#10 din=0; data_valid=0;
		#10 din=2; data_valid=1;
		#10 din=0; data_valid=0;
		$display("%d, \t 1st attempt failed",$time);
		#10 din=1; data_valid=1;
		#10 din=0; data_valid=0;
		#10 din=3; data_valid=1;
		#10 din=0; data_valid=0;
		#10 din=4; data_valid=1;
		#10 din=0; data_valid=0;
		#10 din=4; data_valid=1;
		#10 din=0; data_valid=0;
		 $display("%d, \t 2nd attempt failed",$time);
		#10 din=1; data_valid=1;
		#10 din=0; data_valid=0;
		#10 din=2; data_valid=1;
		#10 din=0; data_valid=0;
```

```
                #10 din=3; data_valid=1;
                #10 din=0; data_valid=0;
                #10 din=4; data_valid=1;
                #10 din=0; data_valid=0;
                $display("%d, \t 3rd attempt failed and lock enters disabled state",$time);
                #10 din=0; data_valid=1;
                #10 din=0; data_valid=0;
                #10 din=0; data_valid=1;
                #10 din=0; data_valid=0;
                #10 din=8; data_valid=1;
                #10 din=0; data_valid=0;
                #10 din=0; data_valid=1;
                #10 din=0; data_valid=0;
                $display("%d, \t Wrong Master Key used 1st time",$time);
                #10 din=0; data_valid=1;
                #10 din=0; data_valid=0;
                #10 din=8; data_valid=1;
                #10 din=0; data_valid=0;
                #10 din=8; data_valid=1;
                #10 din=0; data_valid=0;
                #10 din=8; data_valid=1;
                #10 din=0; data_valid=0;
                $display("%d, \t Wrong Master Key used 2nd time",$time);
                #10 din=0; data_valid=1;
                #10 din=0; data_valid=0;
                #10 din=8; data_valid=1;
                #10 din=0; data_valid=0;
                #10 din=8; data_valid=1;
                #10 din=0; data_valid=0;
                #10 din=8; data_valid=1;
                #10 din=0; data_valid=0;
                $display("%d, \t Wrong Master Key used 3rd time",$time);
end
endtask

task globalreset;
begin
                $display("%d, \t global reset used",$time);
                   reset=0; din=0; data_valid=0;
                #10 reset=1; din=0; data_valid=0;
                #10 din=1;data_valid=1;
                #10 din=0;data_valid=0;
                #10 din=3;data_valid=1;
                #10 din=0;data_valid=0;
                #10 din=9;data_valid=1;
                #10 din=0;data_valid=0;
                #10 din=5;data_valid=1;
                #10 din=0;data_valid=0;
                $display("%d, \t 1395 entered and lock is opened",$time);
end
endtask

task lockkeyinput;
begin
                   $display("%d, \t lock key used to lock the system input",$time);
                   lockkey=1; data_valid=1;
end
endtask
```

```
initial
begin
#1700 $finish;
end
endmodule
```

```
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   0,  Opening the lock on the first attempt
   0  reset=0  din=0    data_valid=1    idlestate=1     disablestate=0    lockopen=0 key=0000 lock=0
  10  reset=1  din=0    data_valid=0    idlestate=1     disablestate=0    lockopen=0 key=0000 lock=0
  20  reset=1  din=1    data_valid=1    idlestate=1     disablestate=0    lockopen=0 key=0000 lock=0
  25  reset=1  din=1    data_valid=1    idlestate=0     disablestate=0    lockopen=0 key=0001 lock=0
  30  reset=1  din=0    data_valid=0    idlestate=0     disablestate=0    lockopen=0 key=0001 lock=0
  40  reset=1  din=3    data_valid=1    idlestate=0     disablestate=0    lockopen=0 key=0001 lock=0
  45  reset=1  din=3    data_valid=1    idlestate=0     disablestate=0    lockopen=0 key=0013 lock=0
  50  reset=1  din=0    data_valid=0    idlestate=0     disablestate=0    lockopen=0 key=0013 lock=0
  60  reset=1  din=9    data_valid=1    idlestate=0     disablestate=0    lockopen=0 key=0013 lock=0
  65  reset=1  din=9    data_valid=1    idlestate=0     disablestate=0    lockopen=0 key=0139 lock=0
  70  reset=1  din=0    data_valid=0    idlestate=0     disablestate=0    lockopen=0 key=0139 lock=0
  80  reset=1  din=5    data_valid=1    idlestate=0     disablestate=0    lockopen=0 key=0139 lock=0
  85  reset=1  din=5    data_valid=1    idlestate=0     disablestate=0    lockopen=1 key=1395 lock=0
  90,          1395 entered and lock is opened
  90  reset=1  din=0    data_valid=0    idlestate=0     disablestate=0    lockopen=1 key=1395 lock=0
 100  reset=1  din=9    data_valid=1    idlestate=0     disablestate=0    lockopen=1 key=1395 lock=0
 105  reset=1  din=9    data_valid=1    idlestate=0     disablestate=0    lockopen=1 key=3959 lock=0
 110  reset=1  din=0    data_valid=0    idlestate=0     disablestate=0    lockopen=1 key=3959 lock=0
 120  reset=1  din=0    data_valid=1    idlestate=0     disablestate=0    lockopen=1 key=3959 lock=1
 125  reset=1  din=0    data_valid=1    idlestate=1     disablestate=0    lockopen=0 key=9590 lock=1
 130  reset=1  din=0    data_valid=0    idlestate=1     disablestate=0    lockopen=0 key=9590 lock=1
 150,          Opening the lock on the second attempt
 150  reset=1  din=1    data_valid=1    idlestate=1     disablestate=0    lockopen=0 key=9590 lock=0
 155  reset=1  din=1    data_valid=1    idlestate=0     disablestate=0    lockopen=0 key=5901 lock=0
 160  reset=1  din=0    data_valid=0    idlestate=0     disablestate=0    lockopen=0 key=5901 lock=0
 170  reset=1  din=2    data_valid=1    idlestate=0     disablestate=0    lockopen=0 key=5901 lock=0
 175  reset=1  din=2    data_valid=1    idlestate=0     disablestate=0    lockopen=0 key=9012 lock=0
 180  reset=1  din=0    data_valid=0    idlestate=0     disablestate=0    lockopen=0 key=9012 lock=0
 190  reset=1  din=1    data_valid=1    idlestate=0     disablestate=0    lockopen=0 key=9012 lock=0
 195  reset=1  din=1    data_valid=1    idlestate=0     disablestate=0    lockopen=0 key=0121 lock=0
 200  reset=1  din=0    data_valid=0    idlestate=0     disablestate=0    lockopen=0 key=0121 lock=0
 210  reset=1  din=2    data_valid=1    idlestate=0     disablestate=0    lockopen=0 key=0121 lock=0
 215  reset=1  din=2    data_valid=1    idlestate=0     disablestate=0    lockopen=0 key=1212 lock=0
 220,          1st attempt failed
 220  reset=1  din=0    data_valid=0    idlestate=0     disablestate=0    lockopen=0 key=1212 lock=0
 230  reset=1  din=1    data_valid=1    idlestate=0     disablestate=0    lockopen=0 key=1212 lock=0
 235  reset=1  din=1    data_valid=1    idlestate=0     disablestate=0    lockopen=0 key=2121 lock=0
 240  reset=1  din=0    data_valid=0    idlestate=0     disablestate=0    lockopen=0 key=2121 lock=0
 250  reset=1  din=3    data_valid=1    idlestate=0     disablestate=0    lockopen=0 key=2121 lock=0
 255  reset=1  din=3    data_valid=1    idlestate=0     disablestate=0    lockopen=0 key=1213 lock=0
 260  reset=1  din=0    data_valid=0    idlestate=0     disablestate=0    lockopen=0 key=1213 lock=0
 270  reset=1  din=9    data_valid=1    idlestate=0     disablestate=0    lockopen=0 key=1213 lock=0
 275  reset=1  din=9    data_valid=1    idlestate=0     disablestate=0    lockopen=0 key=2139 lock=0
 280  reset=1  din=0    data_valid=0    idlestate=0     disablestate=0    lockopen=0 key=2139 lock=0
 290  reset=1  din=5    data_valid=1    idlestate=0     disablestate=0    lockopen=0 key=2139 lock=0
 295  reset=1  din=5    data_valid=1    idlestate=0     disablestate=0    lockopen=1 key=1395 lock=0
 300,          1395 entered and lock is opened
 300  reset=1  din=0    data_valid=0    idlestate=0     disablestate=0    lockopen=1 key=1395 lock=0
 310  reset=1  din=0    data_valid=1    idlestate=0     disablestate=0    lockopen=1 key=1395 lock=1
 315  reset=1  din=0    data_valid=1    idlestate=1     disablestate=0    lockopen=0 key=3950 lock=1
 320  reset=1  din=0    data_valid=0    idlestate=1     disablestate=0    lockopen=0 key=3950 lock=1
 340,          Opening the lock on the third attempt
 340  reset=1  din=1    data_valid=1    idlestate=1     disablestate=0    lockopen=0 key=3950 lock=0
 345  reset=1  din=1    data_valid=1    idlestate=0     disablestate=0    lockopen=0 key=9501 lock=0
```

350 reset=1 din=0 data_valid=0 idlestate=0 disablestate=0 lockopen=0 key=9501 lock=0
360 reset=1 din=2 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=9501 lock=0
365 reset=1 din=2 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=5012 lock=0
370 reset=1 din=0 data_valid=0 idlestate=0 disablestate=0 lockopen=0 key=5012 lock=0
380 reset=1 din=1 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=5012 lock=0
385 reset=1 din=1 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=0121 lock=0
390 reset=1 din=0 data_valid=0 idlestate=0 disablestate=0 lockopen=0 key=0121 lock=0
400 reset=1 din=2 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=0121 lock=0
405 reset=1 din=2 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=1212 lock=0
410, 1st attempt failed
410 reset=1 din=0 data_valid=0 idlestate=0 disablestate=0 lockopen=0 key=1212 lock=0
420 reset=1 din=1 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=1212 lock=0
425 reset=1 din=1 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=2121 lock=0
430 reset=1 din=0 data_valid=0 idlestate=0 disablestate=0 lockopen=0 key=2121 lock=0
440 reset=1 din=2 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=2121 lock=0
445 reset=1 din=2 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=1212 lock=0
450 reset=1 din=0 data_valid=0 idlestate=0 disablestate=0 lockopen=0 key=1212 lock=0
460 reset=1 din=1 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=1212 lock=0
465 reset=1 din=1 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=2121 lock=0
470 reset=1 din=0 data_valid=0 idlestate=0 disablestate=0 lockopen=0 key=2121 lock=0
480 reset=1 din=2 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=2121 lock=0
485 reset=1 din=2 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=1212 lock=0
490, 2nd attempt failed
490 reset=1 din=0 data_valid=0 idlestate=0 disablestate=0 lockopen=0 key=1212 lock=0
500 reset=1 din=1 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=1212 lock=0
505 reset=1 din=1 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=2121 lock=0
510 reset=1 din=0 data_valid=0 idlestate=0 disablestate=0 lockopen=0 key=2121 lock=0
520 reset=1 din=3 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=2121 lock=0
525 reset=1 din=3 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=1213 lock=0
530 reset=1 din=0 data_valid=0 idlestate=0 disablestate=0 lockopen=0 key=1213 lock=0
540 reset=1 din=9 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=1213 lock=0
545 reset=1 din=9 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=2139 lock=0
550 reset=1 din=0 data_valid=0 idlestate=0 disablestate=0 lockopen=0 key=2139 lock=0
560 reset=1 din=5 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=2139 lock=0
565 reset=1 din=5 data_valid=1 idlestate=0 disablestate=0 lockopen=1 key=1395 lock=0
570, 1395 entered and lock is opened
570 reset=1 din=0 data_valid=0 idlestate=0 disablestate=0 lockopen=1 key=1395 lock=0
580 reset=1 din=0 data_valid=1 idlestate=0 disablestate=0 lockopen=1 key=1395 lock=1
585 reset=1 din=0 data_valid=1 idlestate=1 disablestate=0 lockopen=0 key=3950 lock=1
590 reset=1 din=0 data_valid=0 idlestate=1 disablestate=0 lockopen=0 key=3950 lock=1
610, When Master Reset is needed
610 reset=1 din=1 data_valid=1 idlestate=1 disablestate=0 lockopen=0 key=3950 lock=0
615 reset=1 din=1 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=9501 lock=0
620 reset=1 din=0 data_valid=0 idlestate=0 disablestate=0 lockopen=0 key=9501 lock=0
630 reset=1 din=2 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=9501 lock=0
635 reset=1 din=2 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=5012 lock=0
640 reset=1 din=0 data_valid=0 idlestate=0 disablestate=0 lockopen=0 key=5012 lock=0
650 reset=1 din=1 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=5012 lock=0
655 reset=1 din=1 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=0121 lock=0
660 reset=1 din=0 data_valid=0 idlestate=0 disablestate=0 lockopen=0 key=0121 lock=0
670 reset=1 din=2 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=0121 lock=0
675 reset=1 din=2 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=1212 lock=0
680, 1st attempt failed
680 reset=1 din=0 data_valid=0 idlestate=0 disablestate=0 lockopen=0 key=1212 lock=0
690 reset=1 din=1 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=1212 lock=0
695 reset=1 din=1 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=2121 lock=0
700 reset=1 din=0 data_valid=0 idlestate=0 disablestate=0 lockopen=0 key=2121 lock=0
710 reset=1 din=2 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=2121 lock=0
715 reset=1 din=2 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=1212 lock=0

720 reset=1 din=0 data_valid=0 idlestate=0 disablestate=0 lockopen=0 key=1212 lock=0
730 reset=1 din=3 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=1212 lock=0
735 reset=1 din=3 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=2123 lock=0
740 reset=1 din=0 data_valid=0 idlestate=0 disablestate=0 lockopen=0 key=2123 lock=0
750 reset=1 din=4 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=2123 lock=0
755 reset=1 din=4 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=1234 lock=0
760, 2nd attempt failed
760 reset=1 din=0 data_valid=0 idlestate=0 disablestate=0 lockopen=0 key=1234 lock=0
770 reset=1 din=4 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=1234 lock=0
775 reset=1 din=4 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=2344 lock=0
780 reset=1 din=0 data_valid=0 idlestate=0 disablestate=0 lockopen=0 key=2344 lock=0
790 reset=1 din=3 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=2344 lock=0
795 reset=1 din=3 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=3443 lock=0
800 reset=1 din=0 data_valid=0 idlestate=0 disablestate=0 lockopen=0 key=3443 lock=0
810 reset=1 din=2 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=3443 lock=0
815 reset=1 din=2 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=4432 lock=0
820 reset=1 din=0 data_valid=0 idlestate=0 disablestate=0 lockopen=0 key=4432 lock=0
830 reset=1 din=1 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=4432 lock=0
835 reset=1 din=1 data_valid=1 idlestate=0 disablestate=1 lockopen=0 key=4321 lock=0
840, 3rd attempt failed and lock enters disabled state
840 reset=1 din=0 data_valid=0 idlestate=0 disablestate=1 lockopen=0 key=4321 lock=0
870 reset=1 din=8 data_valid=1 idlestate=0 disablestate=1 lockopen=0 key=4321 lock=0
875 reset=1 din=8 data_valid=1 idlestate=0 disablestate=1 lockopen=0 key=3218 lock=0
880 reset=1 din=0 data_valid=0 idlestate=0 disablestate=1 lockopen=0 key=3218 lock=0
890 reset=1 din=0 data_valid=1 idlestate=0 disablestate=1 lockopen=0 key=3218 lock=0
895 reset=1 din=0 data_valid=1 idlestate=0 disablestate=1 lockopen=0 key=2180 lock=0
900 reset=1 din=0 data_valid=0 idlestate=0 disablestate=1 lockopen=0 key=2180 lock=0
910 reset=1 din=8 data_valid=1 idlestate=0 disablestate=1 lockopen=0 key=2180 lock=0
915 reset=1 din=8 data_valid=1 idlestate=0 disablestate=1 lockopen=0 key=1808 lock=0
920 reset=1 din=0 data_valid=0 idlestate=0 disablestate=1 lockopen=0 key=1808 lock=0
930 reset=1 din=0 data_valid=1 idlestate=0 disablestate=1 lockopen=0 key=1808 lock=0
935 reset=1 din=0 data_valid=1 idlestate=1 disablestate=0 lockopen=0 key=8080 lock=0
940, Master reset used and lock came out of disabled
940 reset=1 din=0 data_valid=0 idlestate=1 disablestate=0 lockopen=0 key=8080 lock=0
950 reset=1 din=1 data_valid=1 idlestate=1 disablestate=0 lockopen=0 key=8080 lock=0
955 reset=1 din=1 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=0801 lock=0
960 reset=1 din=0 data_valid=0 idlestate=0 disablestate=0 lockopen=0 key=0801 lock=0
970 reset=1 din=3 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=0801 lock=0
975 reset=1 din=3 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=8013 lock=0
980 reset=1 din=0 data_valid=0 idlestate=0 disablestate=0 lockopen=0 key=8013 lock=0
990 reset=1 din=9 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=8013 lock=0
995 reset=1 din=9 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=0139 lock=0
1000 reset=1 din=0 data_valid=0 idlestate=0 disablestate=0 lockopen=0 key=0139 lock=0
1010 reset=1 din=5 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=0139 lock=0
1015 reset=1 din=5 data_valid=1 idlestate=0 disablestate=0 lockopen=1 key=1395 lock=0
1020, 1395 entered and lock is opened
1020 reset=1 din=0 data_valid=0 idlestate=0 disablestate=0 lockopen=1 key=1395 lock=0
1030 reset=1 din=0 data_valid=1 idlestate=0 disablestate=0 lockopen=1 key=1395 lock=1
1035 reset=1 din=0 data_valid=1 idlestate=1 disablestate=0 lockopen=0 key=3950 lock=1
1040, lock key pressed to lock the system
1040 reset=1 din=0 data_valid=0 idlestate=1 disablestate=0 lockopen=0 key=3950 lock=1
1060, When a wrong master key is used three times
1060 reset=1 din=1 data_valid=1 idlestate=1 disablestate=0 lockopen=0 key=3950 lock=0
1065 reset=1 din=1 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=9501 lock=0
1070 reset=1 din=0 data_valid=0 idlestate=0 disablestate=0 lockopen=0 key=9501 lock=0
1080 reset=1 din=2 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=9501 lock=0
1085 reset=1 din=2 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=5012 lock=0
1090 reset=1 din=0 data_valid=0 idlestate=0 disablestate=0 lockopen=0 key=5012 lock=0
1100 reset=1 din=1 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=5012 lock=0

1105 reset=1 din=1 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=0121 lock=0
1110 reset=1 din=0 data_valid=0 idlestate=0 disablestate=0 lockopen=0 key=0121 lock=0
1120 reset=1 din=2 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=0121 lock=0
1125 reset=1 din=2 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=1212 lock=0
1130, 1st attempt failed
1130 reset=1 din=0 data_valid=0 idlestate=0 disablestate=0 lockopen=0 key=1212 lock=0
1140 reset=1 din=1 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=1212 lock=0
1145 reset=1 din=1 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=2121 lock=0
1150 reset=1 din=0 data_valid=0 idlestate=0 disablestate=0 lockopen=0 key=2121 lock=0
1160 reset=1 din=3 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=2121 lock=0
1165 reset=1 din=3 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=1213 lock=0
1170 reset=1 din=0 data_valid=0 idlestate=0 disablestate=0 lockopen=0 key=1213 lock=0
1180 reset=1 din=4 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=1213 lock=0
1185 reset=1 din=4 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=2134 lock=0
1190 reset=1 din=0 data_valid=0 idlestate=0 disablestate=0 lockopen=0 key=2134 lock=0
1200 reset=1 din=4 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=2134 lock=0
1205 reset=1 din=4 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=1344 lock=0
1210, 2nd attempt failed
1210 reset=1 din=0 data_valid=0 idlestate=0 disablestate=0 lockopen=0 key=1344 lock=0
1220 reset=1 din=1 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=1344 lock=0
1225 reset=1 din=1 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=3441 lock=0
1230 reset=1 din=0 data_valid=0 idlestate=0 disablestate=0 lockopen=0 key=3441 lock=0
1240 reset=1 din=2 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=3441 lock=0
1245 reset=1 din=2 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=4412 lock=0
1250 reset=1 din=0 data_valid=0 idlestate=0 disablestate=0 lockopen=0 key=4412 lock=0
1260 reset=1 din=3 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=4412 lock=0
1265 reset=1 din=3 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=4123 lock=0
1270 reset=1 din=0 data_valid=0 idlestate=0 disablestate=0 lockopen=0 key=4123 lock=0
1280 reset=1 din=4 data_valid=1 idlestate=0 disablestate=0 lockopen=0 key=4123 lock=0
1285 reset=1 din=4 data_valid=1 idlestate=0 disablestate=1 lockopen=0 key=1234 lock=0
1290, 3rd attempt failed and lock enters disabled state
1290 reset=1 din=0 data_valid=0 idlestate=0 disablestate=1 lockopen=0 key=1234 lock=0
1300 reset=1 din=0 data_valid=1 idlestate=0 disablestate=1 lockopen=0 key=1234 lock=0
1305 reset=1 din=0 data_valid=1 idlestate=0 disablestate=1 lockopen=0 key=2340 lock=0
1310 reset=1 din=0 data_valid=0 idlestate=0 disablestate=1 lockopen=0 key=2340 lock=0
1320 reset=1 din=0 data_valid=1 idlestate=0 disablestate=1 lockopen=0 key=2340 lock=0
1325 reset=1 din=0 data_valid=1 idlestate=0 disablestate=1 lockopen=0 key=3400 lock=0
1330 reset=1 din=0 data_valid=0 idlestate=0 disablestate=1 lockopen=0 key=3400 lock=0
1340 reset=1 din=8 data_valid=1 idlestate=0 disablestate=1 lockopen=0 key=3400 lock=0
1345 reset=1 din=8 data_valid=1 idlestate=0 disablestate=1 lockopen=0 key=4008 lock=0
1350 reset=1 din=0 data_valid=0 idlestate=0 disablestate=1 lockopen=0 key=4008 lock=0
1360 reset=1 din=0 data_valid=1 idlestate=0 disablestate=1 lockopen=0 key=4008 lock=0
1365 reset=1 din=0 data_valid=1 idlestate=0 disablestate=1 lockopen=0 key=0080 lock=0
1370, Wrong Master Key used 1st time
1370 reset=1 din=0 data_valid=0 idlestate=0 disablestate=1 lockopen=0 key=0080 lock=0
1380 reset=1 din=0 data_valid=1 idlestate=0 disablestate=1 lockopen=0 key=0080 lock=0
1385 reset=1 din=0 data_valid=1 idlestate=0 disablestate=1 lockopen=0 key=0800 lock=0
1390 reset=1 din=0 data_valid=0 idlestate=0 disablestate=1 lockopen=0 key=0800 lock=0
1400 reset=1 din=8 data_valid=1 idlestate=0 disablestate=1 lockopen=0 key=0800 lock=0
1405 reset=1 din=8 data_valid=1 idlestate=0 disablestate=1 lockopen=0 key=8008 lock=0
1410 reset=1 din=0 data_valid=0 idlestate=0 disablestate=1 lockopen=0 key=8008 lock=0
1420 reset=1 din=8 data_valid=1 idlestate=0 disablestate=1 lockopen=0 key=8008 lock=0
1425 reset=1 din=8 data_valid=1 idlestate=0 disablestate=1 lockopen=0 key=0088 lock=0
1430 reset=1 din=0 data_valid=0 idlestate=0 disablestate=1 lockopen=0 key=0088 lock=0
1440 reset=1 din=8 data_valid=1 idlestate=0 disablestate=1 lockopen=0 key=0088 lock=0
1445 reset=1 din=8 data_valid=1 idlestate=0 disablestate=1 lockopen=0 key=0888 lock=0
1450, Wrong Master Key used 2nd time
1450 reset=1 din=0 data_valid=0 idlestate=0 disablestate=1 lockopen=0 key=0888 lock=0
1460 reset=1 din=0 data_valid=1 idlestate=0 disablestate=1 lockopen=0 key=0888 lock=0

```
1465          reset=1  din=0    data_valid=1     idlestate=0      disablestate=1    lockopen=0 key=8880 lock=0
1470          reset=1  din=0    data_valid=0     idlestate=0      disablestate=1    lockopen=0 key=8880 lock=0
1480          reset=1  din=8    data_valid=1     idlestate=0      disablestate=1    lockopen=0 key=8880 lock=0
1485          reset=1  din=8    data_valid=1     idlestate=0      disablestate=1    lockopen=0 key=8808 lock=0
1490          reset=1  din=0    data_valid=0     idlestate=0      disablestate=1    lockopen=0 key=8808 lock=0
1500          reset=1  din=8    data_valid=1     idlestate=0      disablestate=1    lockopen=0 key=8808 lock=0
1505          reset=1  din=8    data_valid=1     idlestate=0      disablestate=1    lockopen=0 key=8088 lock=0
1510          reset=1  din=0    data_valid=0     idlestate=0      disablestate=1    lockopen=0 key=8088 lock=0
1520          reset=1  din=8    data_valid=1     idlestate=0      disablestate=1    lockopen=0 key=8088 lock=0
1525          reset=1  din=8    data_valid=1     idlestate=0      disablestate=1    lockopen=0 key=0888 lock=0
1530,         Wrong Master Key used 3rd time
1530          reset=1  din=0    data_valid=0     idlestate=0      disablestate=1    lockopen=0 key=0888 lock=0
1550,         global reset used
1550          reset=0  din=0    data_valid=0     idlestate=1      disablestate=0    lockopen=0 key=0000 lock=0
1560          reset=1  din=0    data_valid=0     idlestate=1      disablestate=0    lockopen=0 key=0000 lock=0
1570          reset=1  din=1    data_valid=1     idlestate=1      disablestate=0    lockopen=0 key=0000 lock=0
1575          reset=1  din=1    data_valid=1     idlestate=0      disablestate=0    lockopen=0 key=0001 lock=0
1580          reset=1  din=0    data_valid=0     idlestate=0      disablestate=0    lockopen=0 key=0001 lock=0
1590          reset=1  din=3    data_valid=1     idlestate=0      disablestate=0    lockopen=0 key=0001 lock=0
1595          reset=1  din=3    data_valid=1     idlestate=0      disablestate=0    lockopen=0 key=0013 lock=0
1600          reset=1  din=0    data_valid=0     idlestate=0      disablestate=0    lockopen=0 key=0013 lock=0
1610          reset=1  din=9    data_valid=1     idlestate=0      disablestate=0    lockopen=0 key=0013 lock=0
1615          reset=1  din=9    data_valid=1     idlestate=0      disablestate=0    lockopen=0 key=0139 lock=0
1620          reset=1  din=0    data_valid=0     idlestate=0      disablestate=0    lockopen=0 key=0139 lock=0
1630          reset=1  din=5    data_valid=1     idlestate=0      disablestate=0    lockopen=0 key=0139 lock=0
1635          reset=1  din=5    data_valid=1     idlestate=0      disablestate=0    lockopen=1 key=1395 lock=0
1640,         1395 entered and lock is opened
1640          reset=1  din=0    data_valid=0     idlestate=0      disablestate=0    lockopen=1 key=1395 lock=0
1660,         lock key used to lock the system input
1660          reset=1  din=0    data_valid=1     idlestate=0      disablestate=0    lockopen=1 key=1395 lock=1
1665          reset=1  din=0    data_valid=1     idlestate=1      disablestate=0    lockopen=0 key=3950 lock=1
1675          reset=1  din=0    data_valid=1     idlestate=1      disablestate=0    lockopen=0 key=9500 lock=1
1685          reset=1  din=0    data_valid=1     idlestate=1      disablestate=0    lockopen=0 key=5000 lock=1
1695          reset=1  din=0    data_valid=1     idlestate=1      disablestate=0    lockopen=0 key=0000 lock=1
$finish called from file "lock_tb.v", line 258.
$finish at simulation time                1700
           V C S   S i m u l a t i o n   R e p o r t
Time: 1700
CPU Time:      0.440 seconds;       Data structure size:   0.0Mb
Wed Mar  9 22:43:36 2016
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