**Counter**

module counter (clk,rst,pcount ,pci , pco , ef , ff, H );

input clk , rst , pci ,pco ;

output [2:0] pcount ;

output ef ,ff ,H ;

reg [2:0] pcount = 3'b000;

reg ef\_1 = 1;

reg ff\_1 = 0;

reg H ;

reg add;

always @(posedge clk, rst )

begin

H <= (~pci & ~pco) | (pco & pci) | (pco & ef\_1) | (pci & ff\_1);

add <= (pci & ~pco);

if(rst)

begin

pcount <= 0;

ff\_1 <= 0;

ef\_1<= 1;

end

else if (H==1 )

pcount <= pcount ;

else if (add == 1)

begin

if (pcount <= 3'b110 || ef\_1==1)

begin

pcount <= pcount +1 ;

ff\_1 <= 1'b0;

ef\_1<= 1'b0;

end

else if( 3'b110 < pcount )

begin

pcount <= pcount;

ff\_1 <=1;

ef\_1 <=0;

end

end

else if (add == 0)

begin

if(3'b000 < pcount <= 3'b111)

begin

pcount <= pcount-1;

ff\_1=0;

ef\_1=0;

end

if (pcount == 3'b000)

begin

ef\_1 <= 1'b1 ;

ff\_1=0;

pcount <= pcount;

end

end

end

assign ef = ef\_1;

assign ff = ff\_1;

endmodule

***FSM***

module FSM (clk,rst,in,out);

input clk,rst,in;

output out;

reg state;

reg out;

always @(posedge clk,posedge rst)

begin

if(rst)begin

state <= 1'b0;

out <= 0;

end

else

begin

case(state)

1'b0:

begin

if(in) begin

state <= 1'b0;

out <=0; end

else begin

state <= 1'b1;

out <=1; end

end

1'b1:

begin

if(in) begin

state <= 1'b0;

out <=1; end

else begin

state <= 1'b1;

out <=0; end

end

default: begin

state<= 1'b0;

out<=0; end

endcase

end

end

endmodule

**Rom**

module new\_rom(index,clk,ef,ff,reset,wtime);

input [4:0] index;//index is a five-bit number - the 2-MSBs is tcount | the 3-LSBs is pcount

input clk,ef,ff,reset;

output [4:0] wtime;

function [4:0] wait\_time;

input [4:0] fn\_input,empty\_flag,full\_flag,reset\_;

begin

//reset

if(reset==1) begin

fn\_input=0;

wait\_time=5'b0000;

end

//empty flag check

else if (ef==1)//no of people ==1, no of teller==1

wait\_time=5'b0000;

//full flag check

else if (ff==1) wait\_time=5'b11111;

//tcount=1

else if (1==1)

begin

case (fn\_input)

5'b01001: wait\_time=5'b00011; //pcount =1 --wtime=3

5'b01010: wait\_time=5'b00110; //pcount =2 --wtime=6

5'b01011: wait\_time=5'b01001; //pcount =3 --wtime=9

5'b01100: wait\_time=5'b01100; //pcount =4 --wtime=12

5'b01101: wait\_time=5'b01111; //pcount =5 --wtime=15

5'b01110: wait\_time=5'b10010; //pcount =6 --wtime=18

5'b01111: wait\_time=5'b10101; //pcount =7 --wtime=21

//tcount=2

5'b10001: wait\_time=5'b00011; //pcount =1 --wtime=3

5'b10010: wait\_time=5'b00101; //pcount =2 --wtime=5

5'b10011: wait\_time=5'b00110; //pcount =3 --wtime=6

5'b10100: wait\_time=5'b01000; //pcount =4 --wtime=8

5'b10101: wait\_time=5'b01001; //pcount =5 --wtime=9

5'b10110: wait\_time=5'b01011; //pcount =6 --wtime=11

5'b10111: wait\_time=5'b01100; //pcount =7 --wtime=12

//tcount=3

5'b11001: wait\_time=5'b00011; //pcount =1 --wtime=3

5'b11010: wait\_time=5'b00100; //pcount =1 --wtime=4

5'b11011: wait\_time=5'b00101; //pcount =1 --wtime=5

5'b11100: wait\_time=5'b00110; //pcount =1 --wtime=6

5'b11101: wait\_time=5'b00111; //pcount =1 --wtime=7

5'b11110: wait\_time=5'b01000; //pcount =1 --wtime=8

5'b11111: wait\_time=5'b01001; //pcount =1 --wtime=9

//default

default: wait\_time=5'b0000;

endcase

end

end

endfunction

assign wtime=wait\_time(index,ef,ff,reset);

endmodule

**Mini Prioject**

module mini\_project (clk, reset, Tcount, Pcount, empty\_flag, full\_flag,Hold, Wtime, inx , iny );

input clk, reset,inx,iny;

input [1:0] Tcount;

output [2:0] Pcount;

output empty\_flag ,full\_flag ;

output [4:0] Wtime;

output Hold;

wire pci , pco;

wire inx = 1;

wire iny = 1;

FSM x1 (.clk(clk), .rst(reset) , .in(inx) , .out(pci) ); // for queue back sensor

FSM y1 (.clk(clk), .rst(reset) , .in(iny) , .out(pco) ); // for queue forward sensor

counter st1 (.clk(clk), .rst(reset) , .pcount(Pcount) , .pci(pci) , .pco(pco) , .ef(empty\_flag) , .ff(full\_flag), .H(Hold) );

wire [4:0] index;

assign index = {Tcount , Pcount};

new\_rom st2 (.index(index), .clk(clk) , .ef(empty\_flag) , .ff(full\_flag) , .reset(reset), .wtime(Wtime));

endmodule

module mini\_project\_test;

reg reset\_t, inx\_t, iny\_t ;

reg [1:0] Tcount\_t;

reg clk\_t = 1;

wire empty\_flag\_t, full\_flag\_t;

wire [4:0] Wtime\_t;

wire [2:0] Pcount\_t;

wire Hold\_t;

mini\_project g0 (.clk(clk\_t), .reset(reset\_t) , .Tcount(Tcount\_t) , .Pcount(Pcount\_t), .empty\_flag(empty\_flag\_t), . full\_flag( full\_flag\_t) , .Wtime(Wtime\_t), .inx(inx\_t), .iny(iny\_t), .Hold(Hold\_t) );

initial

begin

forever begin

clk\_t=clk\_t;

#10 clk\_t <=~clk\_t;

end

end

initial begin

reset\_t=0;Tcount\_t=2'b01;inx\_t=1;iny\_t=1; // 000

$display("the wating time for the next person is %d and the empty flag is %b and the full flag is %b",Wtime\_t,empty\_flag\_t,full\_flag\_t);

$display("the Pcount is %b the Tcount is %b",Pcount\_t,Tcount\_t);

#150 Tcount\_t=2'b01;inx\_t=0;iny\_t=1; //001

$display("the wating time for the next person is %d and the empty flag is %b and the full flag is %b",Wtime\_t,empty\_flag\_t,full\_flag\_t);

$display("the Pcount is %b the Tcount is %b",Pcount\_t,Tcount\_t);

#150 Tcount\_t=2'b01;inx\_t=1;iny\_t=1; //010

$display("the wating time for the next person is %d and the empty flag is %b and the full flag is %b",Wtime\_t,empty\_flag\_t,full\_flag\_t);

$display("the Pcount is %b the Tcount is %b",Pcount\_t,Tcount\_t);

#150 Tcount\_t=2'b01;inx\_t=1;iny\_t=0; //001

$display("the wating time for the next person is %d and the empty flag is %b and the full flag is %b",Wtime\_t,empty\_flag\_t,full\_flag\_t);

$display("the Pcount is %b the Tcount is %b",Pcount\_t,Tcount\_t);

#150 Tcount\_t=2'b01;inx\_t=1;iny\_t=1; //000

$display("the wating time for the next person is %d and the empty flag is %b and the full flag is %b",Wtime\_t,empty\_flag\_t,full\_flag\_t);

$display("the Pcount is %b the Tcount is %b",Pcount\_t,Tcount\_t);

#150 Tcount\_t=2'b10;inx\_t=0;iny\_t=1; //001

$display("the wating time for the next person is %d and the empty flag is %b and the full flag is %b",Wtime\_t,empty\_flag\_t,full\_flag\_t);

$display("the Pcount is %b the Tcount is %b",Pcount\_t,Tcount\_t);

#150 Tcount\_t=2'b10;inx\_t=1;iny\_t=1; //010

$display("the wating time for the next person is %d and the empty flag is %b and the full flag is %b",Wtime\_t,empty\_flag\_t,full\_flag\_t);

$display("the Pcount is %b the Tcount is %b",Pcount\_t,Tcount\_t);

#150 Tcount\_t=2'b10;inx\_t=1;iny\_t=0; //001

$display("the wating time for the next person is %d and the empty flag is %b and the full flag is %b",Wtime\_t,empty\_flag\_t,full\_flag\_t);

$display("the Pcount is %b the Tcount is %b",Pcount\_t,Tcount\_t);

#150 Tcount\_t=2'b10;inx\_t=1;iny\_t=1; // 000

if ( Pcount\_t<3'b001 && empty\_flag\_t==1 && Hold\_t == 1 ) $display("there is no one to go out of the queue");

$display("the wating time for the next person is %d and the empty flag is %b and the full flag is %b",Wtime\_t,empty\_flag\_t,full\_flag\_t);

$display("the Pcount is %b the Tcount is %b",Pcount\_t,Tcount\_t);

#150 Tcount\_t=2'b10;inx\_t=1;iny\_t=0;//test no one in queue

if ( Pcount\_t<3'b001 && empty\_flag\_t==1 && Hold\_t == 1 ) $display("there is no one to go out of the queue");

$display("the wating time for the next person is %d and the empty flag is %b and the full flag is %b",Wtime\_t,empty\_flag\_t,full\_flag\_t);

$display("the Pcount is %b the Tcount is %b",Pcount\_t,Tcount\_t);

#150 Tcount\_t=2'b10;inx\_t=0;iny\_t=0; //001

if ( Pcount\_t<3'b001 && empty\_flag\_t==1 && Hold\_t == 1 ) $display("there is no one to go out of the queue");

$display("the wating time for the next person is %d and the empty flag is %b and the full flag is %b",Wtime\_t,empty\_flag\_t,full\_flag\_t);

$display("the Pcount is %b the Tcount is %b",Pcount\_t,Tcount\_t);

#150 Tcount\_t=2'b10;inx\_t=1;iny\_t=0; //010

$display("the wating time for the next person is %d and the empty flag is %b and the full flag is %b",Wtime\_t,empty\_flag\_t,full\_flag\_t);

$display("the Pcount is %b the Tcount is %b",Pcount\_t,Tcount\_t);

#150 Tcount\_t=2'b10;inx\_t=0;iny\_t=0;

$display("the wating time for the next person is %d and the empty flag is %b and the full flag is %b",Wtime\_t,empty\_flag\_t,full\_flag\_t);

$display("the Pcount is %b the Tcount is %b",Pcount\_t,Tcount\_t);

#150 Tcount\_t=2'b10;inx\_t=1;iny\_t=0;

$display("the wating time for the next person is %d and the empty flag is %b and the full flag is %b",Wtime\_t,empty\_flag\_t,full\_flag\_t);

$display("the Pcount is %b the Tcount is %b",Pcount\_t,Tcount\_t);

#150 Tcount\_t=2'b10;inx\_t=0;iny\_t=0;

$display("the wating time for the next person is %d and the empty flag is %b and the full flag is %b",Wtime\_t,empty\_flag\_t,full\_flag\_t);

$display("the Pcount is %b the Tcount is %b",Pcount\_t,Tcount\_t);

#150 Tcount\_t=2'b10;inx\_t=1;iny\_t=0;

$display("the wating time for the next person is %d and the empty flag is %b and the full flag is %b",Wtime\_t,empty\_flag\_t,full\_flag\_t);

$display("the Pcount is %b the Tcount is %b",Pcount\_t,Tcount\_t);

#150 Tcount\_t=2'b10;inx\_t=0;iny\_t=0; // before full queue

if ( Pcount\_t<3'b001 && empty\_flag\_t==1 && Hold\_t == 1 ) $display("there is no one to go out of the queue");

else if ( Pcount\_t>3'b110 && full\_flag\_t==1 && Hold\_t == 1) $display("the queue is full");

$display("the wating time for the next person is %d and the empty flag is %b and the full flag is %b",Wtime\_t,empty\_flag\_t,full\_flag\_t);

$display("the Pcount is %b the Tcount is %b",Pcount\_t,Tcount\_t);

#150 Tcount\_t=2'b10;inx\_t=1;iny\_t=0;// test full queue

if ( Pcount\_t<3'b001 && empty\_flag\_t==1 && Hold\_t == 1 ) $display("there is no one to go out of the queue");

else if ( Pcount\_t==3'b111 && full\_flag\_t==1 && Hold\_t == 1) $display("the queue is full");

$display("the wating time for the next person is %d and the empty flag is %b and the full flag is %b",Wtime\_t,empty\_flag\_t,full\_flag\_t);

$display("the Pcount is %b the Tcount is %b",Pcount\_t,Tcount\_t);

#150 Tcount\_t=2'b10;inx\_t=1;iny\_t=1;// test full queue 2

if ( Pcount\_t<3'b001 && empty\_flag\_t==1 && Hold\_t == 1 ) $display("there is no one to go out of the queue");

else if (Pcount\_t==3'b111 && full\_flag\_t==1 && Hold\_t == 1) $display("the queue is full");

$display("the wating time for the next person is %d and the empty flag is %b and the full flag is %b",Wtime\_t,empty\_flag\_t,full\_flag\_t);

$display("the Pcount is %b the Tcount is %b",Pcount\_t,Tcount\_t);

end

endmodule