

# Lab1

## Flash LED

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# Lab1

- ❖ 此次實驗使用到的I/O
  - ◆ 中間Butten(S2)作為輸入
  - ◆ 16顆LED燈做為輸出
- ❖ 功能
  - ◆ 學會「除頻」技術，降低頻率，控制LED燈依序閃爍。
  - ◆ 並讀取按鍵是否按下，進而決定跑馬燈方向。



# Verilog code

```
//模組名稱
module flash_led_top(
    input clk,
    input rst_n,
    input btn_c,
    output [15:0] led
);

//暫存器宣告
reg [15:0] led;
reg [24:0] count;

wire d_clk;

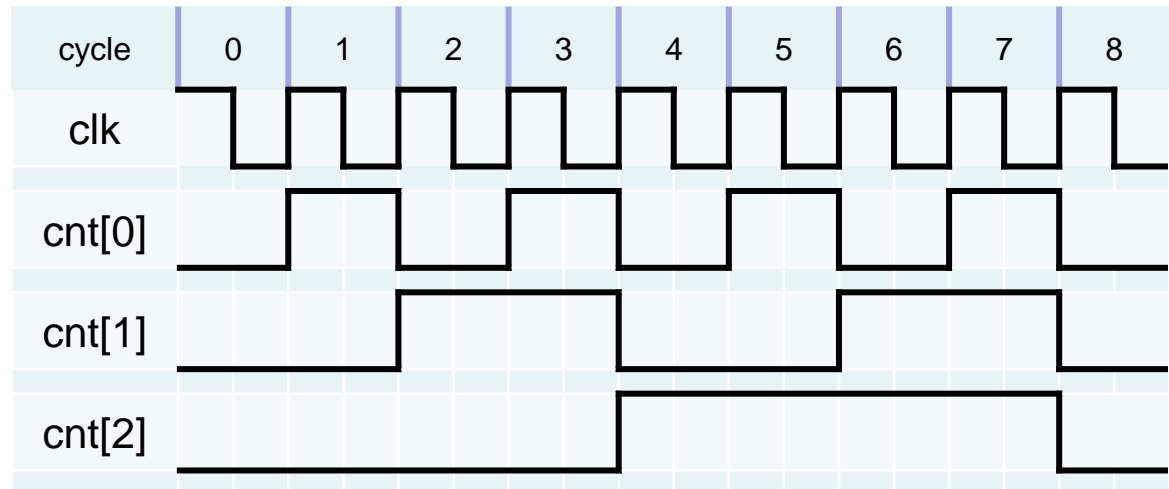
//除頻
always @(posedge clk or negedge rst_n)begin
    if(!rst_n)
        count <= 0;
    else
        count <= count + 1;
end
assign d_clk = count[24];
```

```
//LED燈號控制
always @( posedge d_clk or negedge rst_n ) begin
    if(!rst_n)
        led <= 16'b1000_0000_0000_0000;
    else begin
        case( btn_c ) 判斷按鍵是否按下
            0:begin
                if( led != 16'b0000_0000_0000_0001 )begin
                    led <= led >> 1; 算術右移
                end
            end
            else begin
                led <= 16'b1000_0000_0000_0000;
            end
        end
        1:begin
            if( led != 16'b1000_0000_0000_0000 )begin
                led <= led << 1'b1; 算術左移
            end
        end
        else begin
            led <= 16'b0000_0000_0000_0001;
        end
    end
endcase
end
endmodule
```

# 除頻

- ❖ 透過計數器累加，讀取計數器某一位元，做為新的時脈。
- ❖ 3 bit 計數器 counter (cnt)

cycle	cnt[2]	cnt[1]	cnt[0]
0	0	0	0
1	0	0	1
2	0	1	0
3	0	1	1
4	1	0	0
5	1	0	1
6	1	1	0
7	1	1	1



# Lab1 constraint file

名稱	電路圖訊號	FPGA IO PIN
時鐘接腳	SYS_CLK	P17

名稱	電路圖訊號	FPGA IO PIN
重置接腳	FPGA_RESET	P15

名稱	電路圖訊號	FPGA IO PIN
S0	PB0	R11
S1	PB1	R17
S2	PB2	R15
S3	PB3	V1
S4	PB4	U4

# Lab1 constraint file

名稱	電路圖訊號	FPGA IO PIN	顏色
D0	LED0	F6	Green
D1	LED1	G4	Green
D2	LED2	G3	Green
D3	LED3	J4	Green
D4	LED4	H4	Green
D5	LED5	J3	Green
D6	LED6	J2	Green
D7	LED7	K2	Green
D8	LED8	K1	Green
D9	LED9	H6	Green
D10	LED10	H5	Green
D11	LED11	J5	Green
D12	LED12	K6	Green
D13	LED13	L1	Green
D14	LED14	M1	Green
D15	LED15	K3	Green

# Lab1 作業(下午班)

- ❖ 下午班:
- ❖ 將Lab1稍作修改，設計功能如下:

- ◆ 1.降低跑馬燈的速度
- ◆ 2.改為從兩側到中間

★ 1.(○ ● ● ● ● ● ● ○ ● ● ● ● ● ● ● ● ○)  
★ 2.(● ○ ● ● ● ● ○ ● ● ● ● ● ● ● ● ○ ●)  
★ 3.(● ● ○ ● ● ○ ● ● ● ● ● ● ● ● ○ ● ●)  
★ 4.(● ● ● ○ ○ ● ● ● ● ● ● ● ● ○ ● ● ●)  
★ 5.(○ ● ● ● ● ● ● ○ ● ● ● ● ○ ● ● ● ● ●)

- ◆ 3.按下中間按鍵，改為從中間到兩側

# Lab1 作業(晚上班)

❖ 晚上班:

❖ 將Lab1稍作修改，設計功能如下:

- ◆ 1.提高跑馬燈的速度
- ◆ 2.改為從兩側到中間，並同時有四顆燈亮著

★ 1.(○ ● ● ● ● ● ● ○ ○ ● ● ● ● ● ● ○)

★ 2.(● ○ ● ● ● ● ○ ● ● ○ ● ● ● ● ○ ●)

★ 3.(● ● ○ ● ● ○ ● ● ● ● ○ ● ● ○ ● ●)

★ 4.(● ● ● ○ ○ ● ● ● ● ● ● ○ ○ ● ● ●)

★ 5.(○ ● ● ● ● ● ● ○ ○ ● ● ● ● ● ● ○)

- ◆ 3.按下中間按鍵，改為從中間到兩側





# Thank you for your attention!

