LAB - 10

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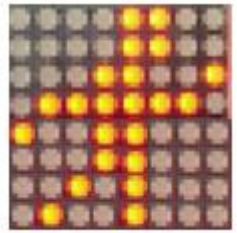
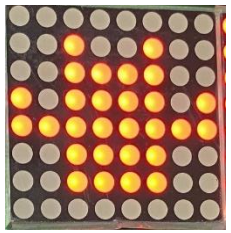
Traffic Light System

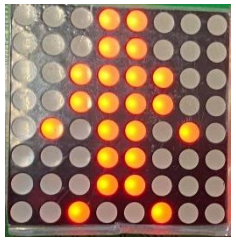
- 請設計一紅綠燈系統電路(變化順序: 綠 -> 黃 -> 紅)
- 電路腳位
  - **Input: clock(CLOCK_50)、reset(reset button)**
  - **Output: dot_row(8 bits)、dot_col(8 bits)、out(7 bits)**
- 使用七段顯示器根據燈號進行倒數(16進制)
  - 綠燈: 15數到0
  - 黃燈: 5數到0
  - 紅燈: 10數到0
- Reset按鈕控制:
  - 將系統設為初始狀態：燈號為綠燈，顯示綠燈圖像，計數器設為15



綠燈



黃燈



紅燈

Hint

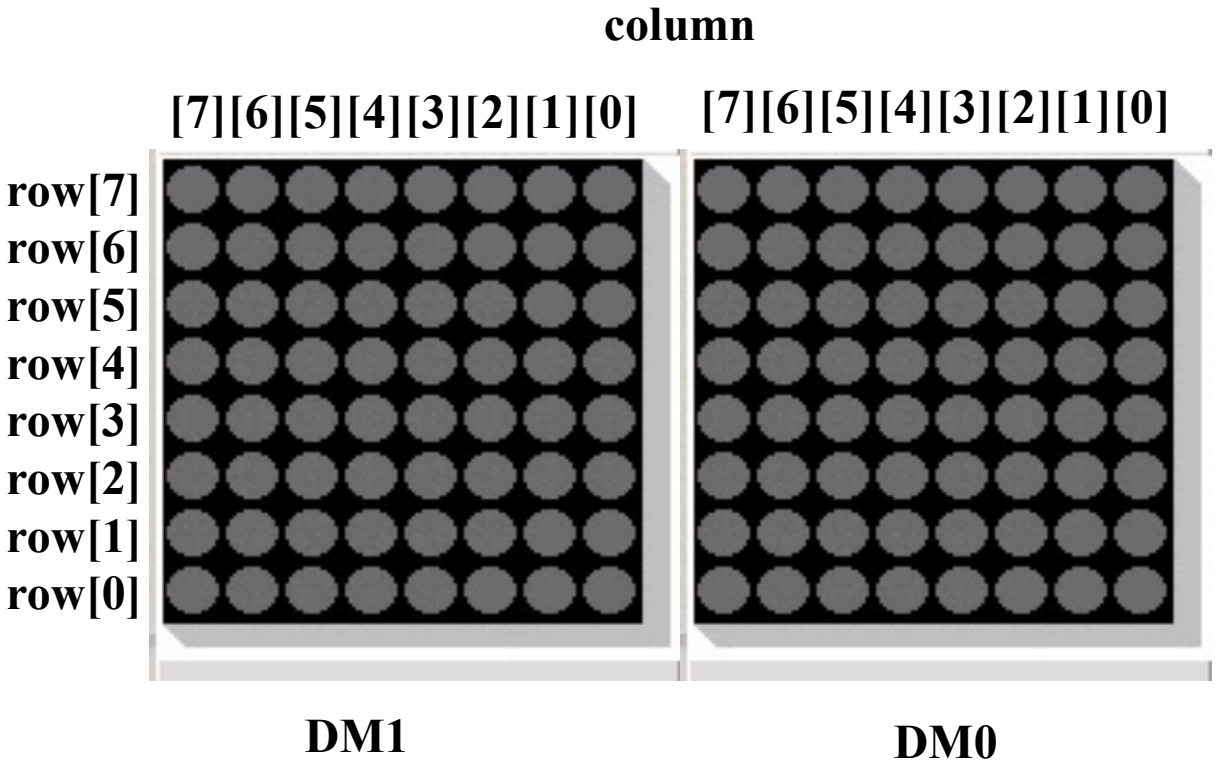
- 使用兩個除頻器
  - 一個用於計數及state切換 (1Hz)
  - 一個用於點矩陣顯示 (10000Hz)
- 在state machine加入條件判斷，當計數為0時切換state
- The example for dot matrix control

```
always@ (posedge clk_div or negedge rst ) begin
        if (~rst) begin
            dot_row <= 8'b0;
            dot_col <= 8'b0;
            row_count <= 0;
        end
        else begin
            row_count <= row_count + 1;
            case (row_count)
                3'd0: dot_row <= 8'b01111111;
                3'd1: dot_row <= 8'b10111111;
                3'd2: dot_row <= 8'b11011111;
                3'd3: dot_row <= 8'b11101111;
                3'd4: dot_row <= 8'b11110111;
                3'd5: dot_row <= 8'b11111011;
                3'd6: dot_row <= 8'b11111101;
                3'd7: dot_row <= 8'b11111110;
            endcase
            case (row_count)
                /*
                    design col signals here
                */
            endcase

        end
    end
```

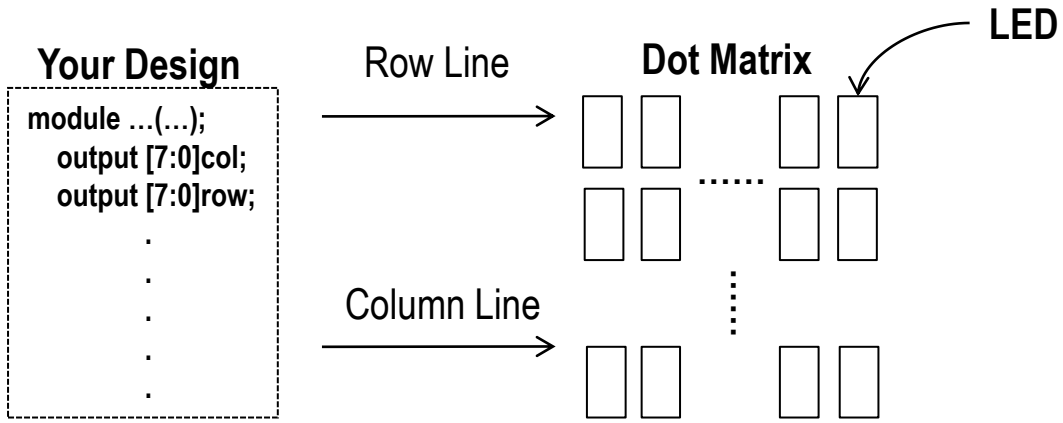
LED Dot Matrix Display (1/3)

- In DE0-CV external board

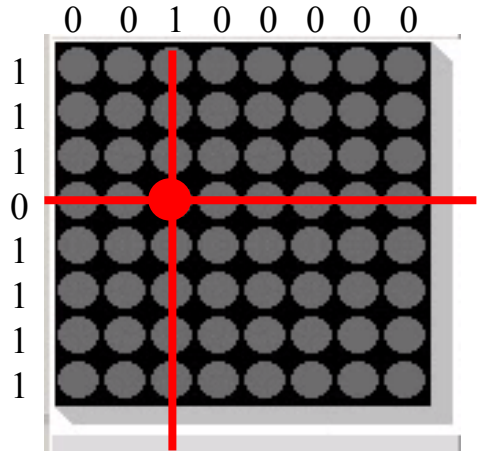


LED Dot Matrix Display (2/3)

- The dot matrix is controlled by 8 column lines and 8 row lines.
- When the signal of column is 1 and the signal of row is 0, the dot will be turned on.

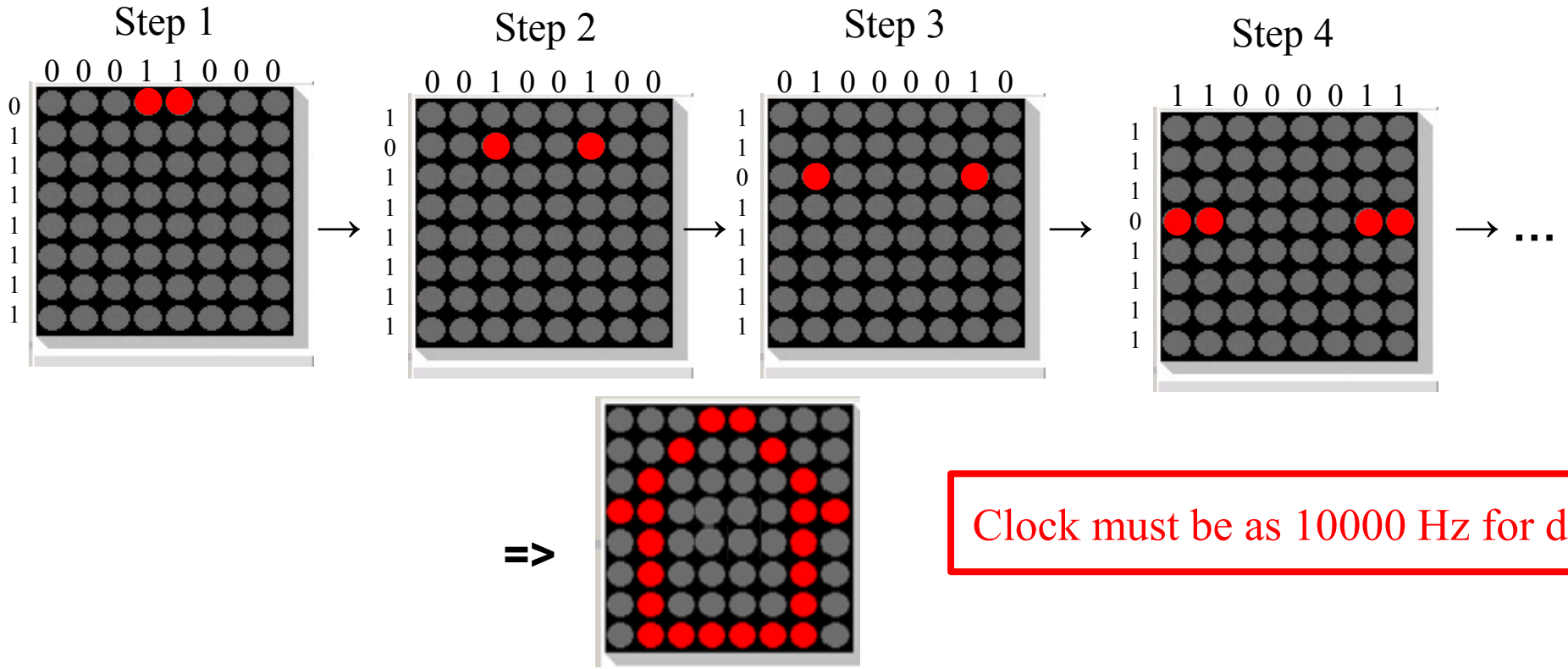


row[4] = 0
column[5] = 1



LED Dot Matrix Display (3/3)

- Scan the rows in turns frequently and control the column lines according to the row in operation, thus the image will be shown due to **Persistence of vision.**



Clock must be as 10000 Hz for display !!!

Notice

- 請勿命名中文或數字開頭的資料夾
- Device family 請確認與 FPGA Chip 符合 (5CEFA4F23C7)
- Top module name & Project name 需要一致
- 在組合電路中，case、if…else…若沒有寫滿，合成後會產生latch