



Lab4 7-Seg LED

實驗四 7-Seg LED

1. Lab objectives 實驗目的

- Understand the principle of using MAX7219.
- Design the program of 7-Seg LED.

- 了解 MAX7219 使用原理
- 設計 7-Seg LED 程式

2. Lab theory 實驗原理

Please check the course material of lab4_note

請參考 lab4_note 課程講義。

3. Steps 實驗步驟

3.1. Lab4.1: Max7219 與 7-Seg LED練習 (Practice of Max7219 and 7-Seg LED) — without code B decode mode (30%)

將 stm32 的 3.3V 接到 7-Seg LED 板的 VCC，GND 接到 GND，並選擇三個 GPIO 接腳分別接到 DIN、CS 和 CLK。



完成以下程式碼，並利用 GPIO 控制 Max7219 並在 7-Seg LED 上的第一位依序顯示 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, b, C, d, E, F (時間間隔1秒)，範例影片如下：

<https://goo.gl/ZDZcdl>

Note:由於 decode mode 無法顯示 AbCdF 等字，因此請將 decode mode 關掉。(參考 lab4_note 講義的 table 6)

Connect 3.3V and GND pin on STM32 to VCC and GND port on MAX7219. Choose three GPIO ports on STM32 for DIN, CS and CLK on MAX7219.



Complete the code giving below and display 0, 1, 2, 3..., 9, A, b, C, d, E, F to the first digit of 7-Seg LED at 1 second interval. Example video link is giving above.

Note: Due to the fact that decode mode is unable to display alphabets, please disable decode mode(ref: lab4_note table 6).

```
.syntax unified
.cpu cortex-m4
.thumb
.data
    arr: .byte 0x0, 0x0, 0x0, 0x0, 0x0, 0x0, 0x0, 0x0, 0x0, 0x0, 0x0,
0x0, 0x0, 0x0, 0x0, 0x0 //TODO: put 0 to F 7-Seg LED pattern here

.text
.global main

main:
    BL    GPIO_init
    BL    max7219_init
loop:
    BL    Display0toF
    B     loop

GPIO_init:
    //TODO: Initialize three GPIO pins as output for max7219 DIN, CS
and CLK
    BX     LR

Display0toF:
    //TODO: Display 0 to F at first digit on 7-SEG LED. Display one
per second.
    BX     LR

MAX7219Send:
    //input parameter: r0 is ADDRESS , r1 is DATA
    //TODO: Use this function to send a message to max7219
    BX     LR

max7219_init:
    //TODO: Initialize max7219 registers
    BX     LR

Delay:
    //TODO: Write a delay 1sec function
    BX     LR
```

3.2. Lab4.2: Max7219 與 7-Seg LED 練習 (Practice of Max7219 and 7-Seg LED) — use code B decode mode (30%)

利用 GPIO 控制 Max7219 並在 7-Seg LED 上顯示自己的學號，例如學號為 1234567 則顯示下圖：



完成以下程式碼，將放在 `student_id` array 裡的學號顯示到 7-seg LED 上。

Note: 請使用 decode mode

Using GPIO output to display your student ID on 7-Seg LED. Picture above is showing the case that your student ID is 1234567.

Complete the code giving below. Put your student ID in **`student_id`** array and display it to 7-Seg LED.

Note: Please enable decode mode.

```
.syntax unified
.cpu cortex-m4
.thumb

.data
student_id: .byte 1, 2, 3, 4, 5, 6, 7 //TODO: put your student id
here

.text
.global main

main:
    BL    GPIO_init
    BL    max7219_init
    //TODO: display your student id on 7-Seg LED
Program_end:
    B Program_end

GPIO_init:
    //TODO: Initialize three GPIO pins as output for max7219 DIN, CS
    and CLK
    BX LR

MAX7219Send:
    //input parameter: r0 is ADDRESS , r1 is DATA
    //TODO: Use this function to send a message to max7219
    BX LR

max7219_init:
    //TODO: Initial max7219 registers.
    BX LR
```



3.3. Lab4.3 Max7219 與 7-SEG LED 練習 (Practice of Max7219 and 7-Seg LED) — 顯示 Fibonacci 數 (Show the Fibonacci number) (40%)

請設計一組語程式偵測實驗板上的 User button，當 User button 按 N 次時 7-Seg LED 上會顯示 fib(N) 的值。User button 長按 1 秒則將數值歸零。

$\text{fib}(0) = 0$ 、 $\text{fib}(1) = 1$ 、 $\text{fib}(2) = 1$ 、...

若 $\text{fib}(N) \geq 100000000$ 則顯示-1。

範例影片如下：

<https://goo.gl/6DF6eY>

Note: 請記得處理 User button 開關彈跳的問題。

Design a program to detect user button on STM32 pressed. When user button is pressed N times, display fib(N) on 7-Seg LED. When user button is held down for 1 second, set displayed number to 0. Example video link is given above.

$\text{fib}(0) = 0$, $\text{fib}(1) = 1$, $\text{fib}(2) = 1$,

if $\text{fib}(N) \geq 100000000$ then display -1.

Note: Please remember to deal with the bouncing problem.