實驗五 7-Seg LED

1. 實驗目的

- 了解 MAX7219 使用原理
- 設計 7-Seg LED 程式

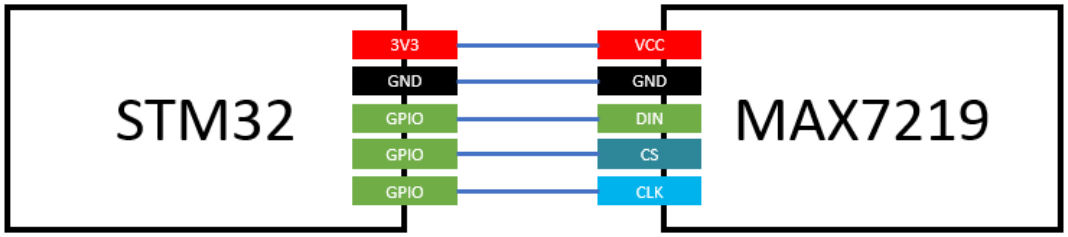
2. 實驗原理

請參考上課 lab5_note 講義。

3. 實驗步驟

3.1. Lab5.1: Max7219 與 7-Seg LED 練習—without code B decode mode

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 上顯的第一位依序顯示 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 lab5_note 講義的 table 6)

Connect 3.3V and GND pin on STM32 to VCC and GND port on MAX7219. Choose three GIPO 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: lab5_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. Lab5.2: Max7219 與 7-Seg LED 練習—use code B decode mode

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. Lab5.3 Max7219 與 7-SEG LED 練習—顯示 Fibonacci 數

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。

fib(0) = 0、fib(1) = 1、fib(2) = 1 、…

若 fib(N) ≥ 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.

fib(0) = 0, fib(1) = 1, fib(2) = 1, ……

if fib(N) ≥ 100000000 then display -1.

Note: Please remember to deal with the bouncing problem.