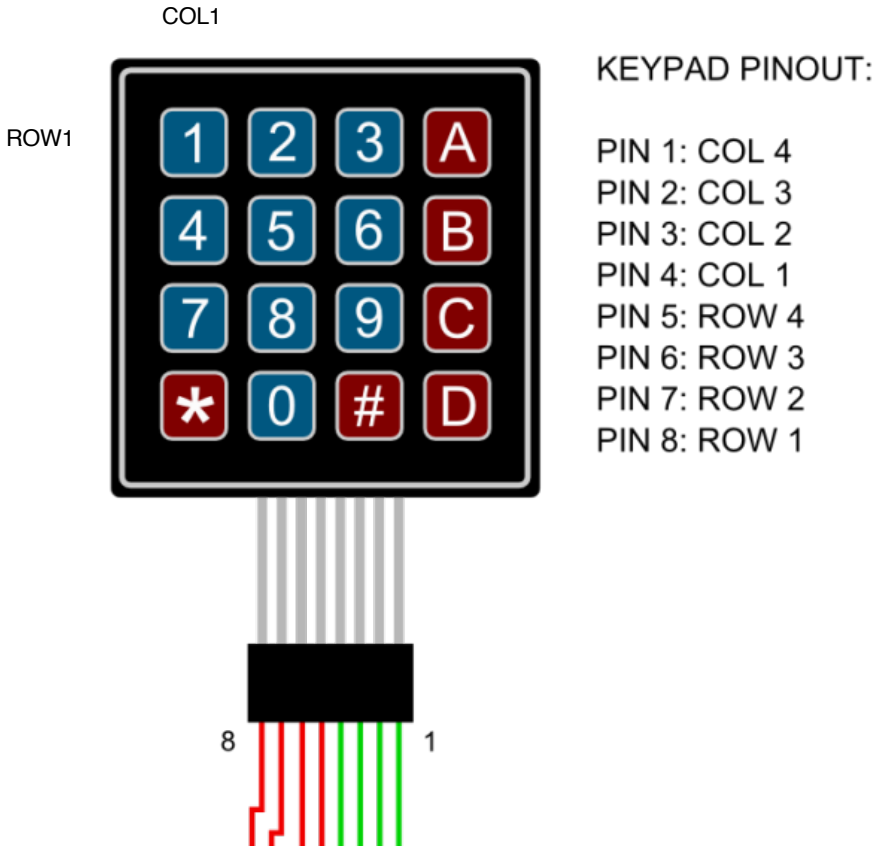
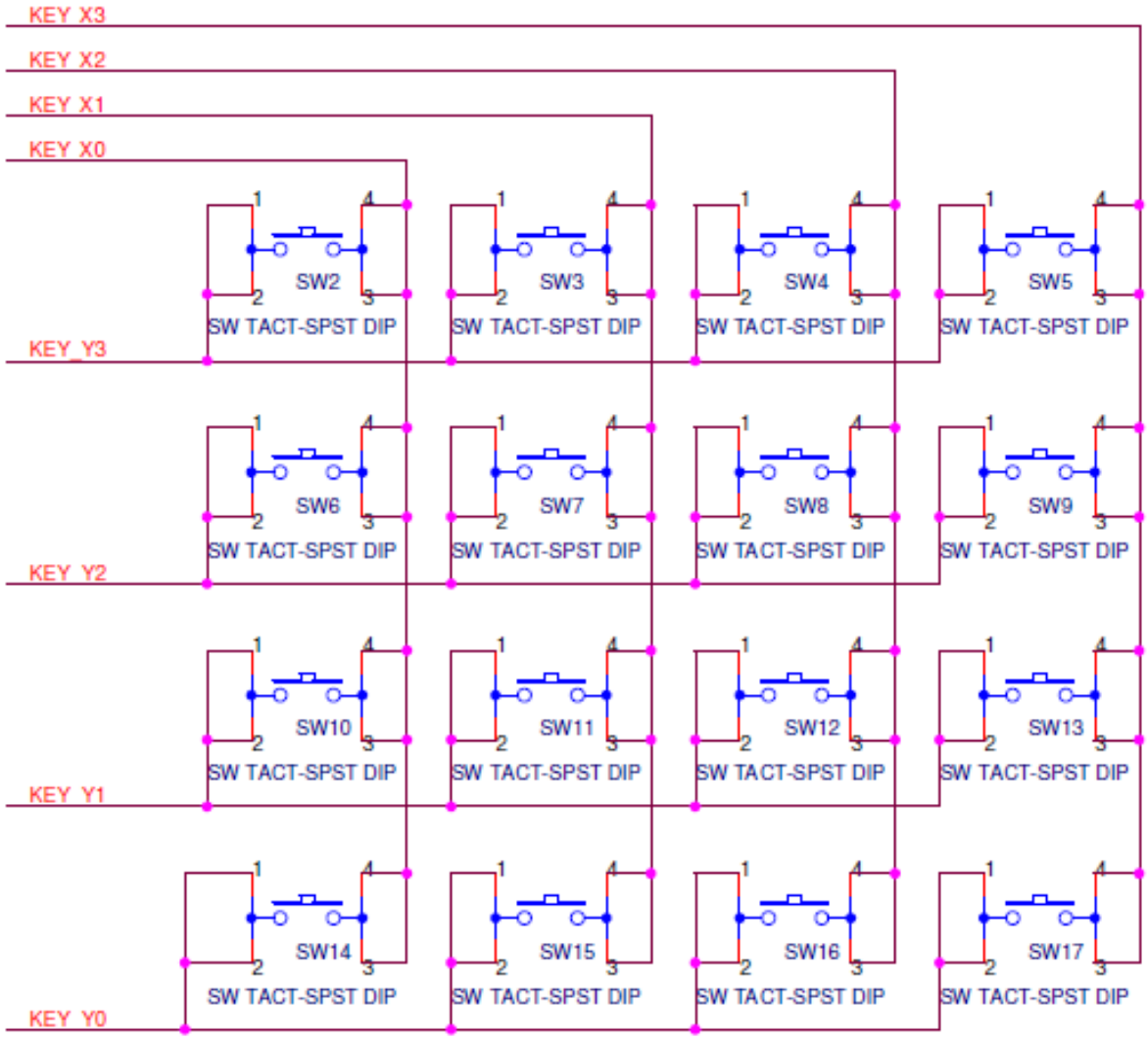
Keypad Scanning

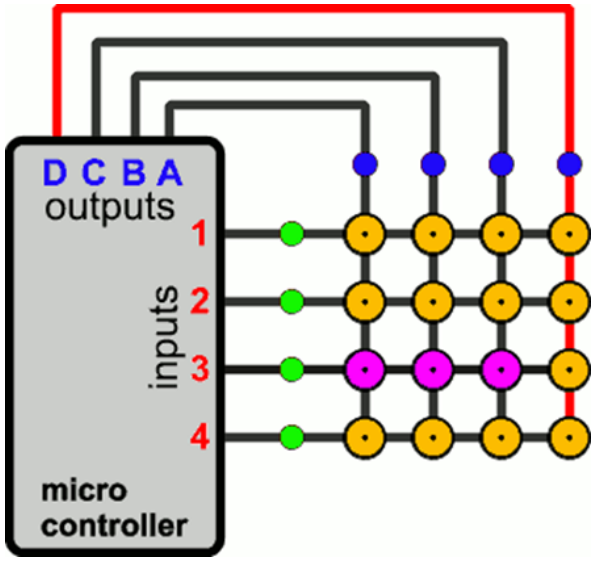
Keypad Pins


COL1
ROW1
1 2 3 A
4 5 6 B
7 8 9 C
* 0 # D
8
1
KEYPAD PINOUT:
PIN 1: COL 4
PIN 2: COL 3
PIN 3: COL 2
PIN 4: COL 1
PIN 5: ROW 4
PIN 6: ROW 3
PIN 7: ROW 2
PIN 8: ROW 1

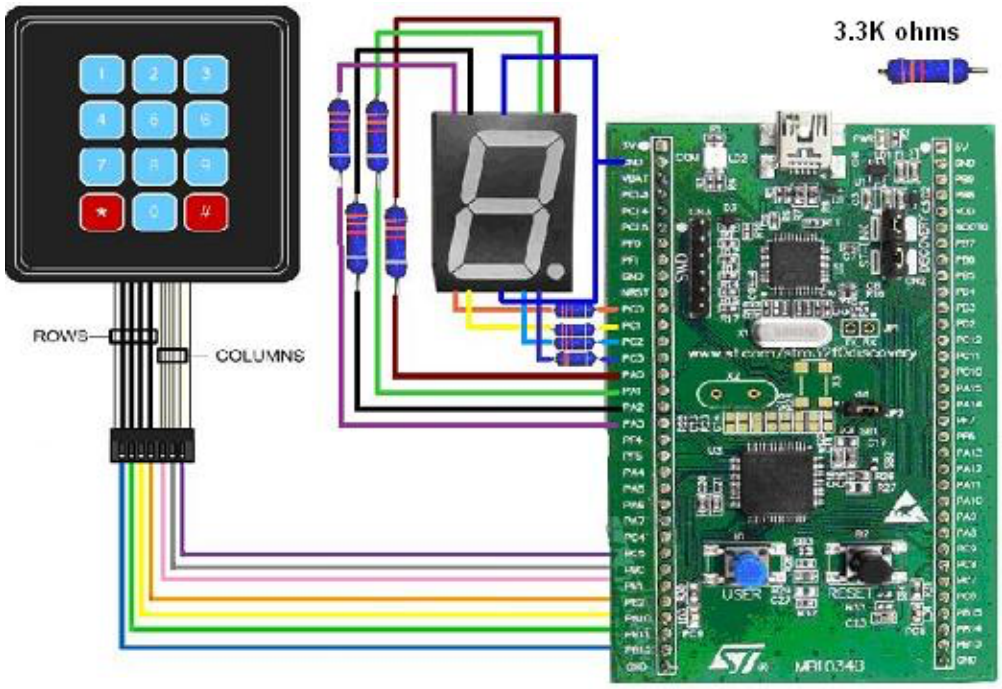
Keypad circuits



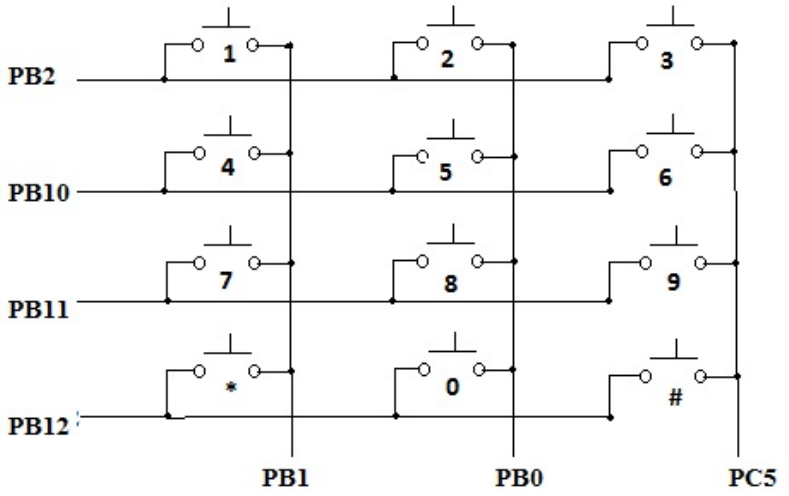
Connect micro-controller to Keypad



Example



SET PINS PC5	SET PINS PB0	SET PINS PB1	PRESSED KEY	OUTPUT PINS PB2	OUTPUT PINS PB10	OUTPUT PINS PB11	OUTPUT PINS PB12
1	0	0	#	0	0	0	1
			9	0	0	1	0
			6	0	1	0	0
			3	1	0	0	0
0	1	0	0	0	0	0	1
			8	0	0	1	0
			5	0	1	0	0
			2	1	0	0	0
0	0	1	*	0	0	0	1
			7	0	0	1	0
			4	0	1	0	0
			1	1	0	0	0



```
int main(void)
{ initgpio();

while(1)
{  GPIOC->BSRR = GPIO_Pin_5;//set bit as high
   GPIOB->BRR = GPIO_Pin_0;//set bit as low
   GPIOB->BRR = GPIO_Pin_1;//set bit as low
{  if(GPIO_ReadInputDataBit(GPIOB, GPIO_Pin_12))
   display(3);
   if(GPIO_ReadInputDataBit(GPIOB, GPIO_Pin_11))
   display(6);
   if(GPIO_ReadInputDataBit(GPIOB, GPIO_Pin_10))
   display(9);
   if(GPIO_ReadInputDataBit(GPIOB, GPIO_Pin_2))
   display(11); }
   GPIOC->BRR = GPIO_Pin_5;//set bit as low
   GPIOB->BSRR = GPIO_Pin_0;//set bit as high
   GPIOB->BRR = GPIO_Pin_1;//set bit as low
```

```
{  if(GPIO_ReadInputDataBit(GPIOB, GPIO_Pin_12))
   display(2);
   if(GPIO_ReadInputDataBit(GPIOB, GPIO_Pin_11))
   display(5);
   if(GPIO_ReadInputDataBit(GPIOB, GPIO_Pin_10))
   display(8);
   if(GPIO_ReadInputDataBit(GPIOB, GPIO_Pin_2))
   display(0);}
   GPIOC->BRR = GPIO_Pin_5;//set bit as low
   GPIOB->BRR = GPIO_Pin_0;//set bit as low
   GPIOB->BSRR = GPIO_Pin_1;//set bit ashigh
{  if(GPIO_ReadInputDataBit(GPIOB, GPIO_Pin_12))
   display(1);
   if(GPIO_ReadInputDataBit(GPIOB, GPIO_Pin_11))
   display(4);
   if(GPIO_ReadInputDataBit(GPIOB, GPIO_Pin_10))
   display(7);
   if(GPIO_ReadInputDataBit(GPIOB, GPIO_Pin_2))
   display(10);}}}
```

Lab 6.0: Max7219 displayer

- 將Lab5所完成的GPIO_init()與MAX7219_send()改成可以被C所呼叫的assembly function，並新增一個C file完成display function及利用max7219_send()將學號顯示於7段顯示器上。

```
//These functions inside the asm file
extern void GPIO_init();
extern void max7219_init();
extern void max7219_send(unsigned char address, unsigned char data);

/**
* TODO: Show data on 7-seg via max7219_send
* Input:
*     data: decimal value
*     num_digs: number of digits will show on 7-seg
* Return:
*     0: success
*     -1: illegal data range(out of 8 digits range)
*/
int display(int data, int num_digs)
{
}
int main()
{
   int student_id = 01234567;
   GPIO_init();
   max7219_init();
   display(student_id, 8);
}
```

```
.text
.global GPIO_init
.global max7219_send
.global max7219_init

GPIO_init:
	//enable gpioa clock
	ldr r0, =#RCC_BASE
	ldr r1, =#AHB2ENR_OFFSET
	ldr r2, =#RCC_AHB2ENR_GPIOAEN
	ldr r3, [r0, r1]//r3 = RCC->AHB2ENR
	orr r3, r3, r2
	str r3, [r0,r1]
	ldr r4, [r0,r1]
	and r4, r4, r2

	ldr r0, =#GPIO_PIN_MASK
	mvn r0, r0
	ldr r1, =#GPIOA_BASE
	//setting moder
	//setting ospeedr
	//setting pupdr
	//setting otyper
	BX LR
```

```
max7219_init:
	push {r0, r1, lr}
	ldr r0, =#DECODE_MODE
	ldr r1, =#0x3
	BL max7219_send
...
	pop {r0, r1, pc}
```

```
max7219_send:////  put lab5 code here ,input parameter: r0 is address , r1 is data
        push {r0, r1, r2, r3, r4, r5, r6, r7, r8, r9}
        lsl r0, r0, #8
        add r0, r0, r1
        ldr r1, =#GPIOA_BASE
        ldr r2, =#LOAD
        ldr r3, =#DATA
        ldr r4, =#CLOCK
        ldr r5, =#GPIO_BSRR_OFFSET
        ldr r6, =#GPIO_BRR_OFFSET
...
        pop {r0, r1, r2, r3, r4, r5, r6, r7, r8, r9}
        BX LR
```

Lab6.1: Keypad Scanning

- 利用4個input GPIO與4個output GPIO pin連接keypad，當按下keypad利用lab6.0所實做的display()將所對應的數字顯示在兩顆七段顯示器上，無按則不顯示。

```
int main()
{       GPIO_init();
        max7219_init();
        keypad_init();
        while(1){
             flag_keypad=GPIOB->IDR&10111<<5;
                        if(flag_keypad!=0){
                                   k=45000;
                        while(k!=0){
                            flag_debounce=GPIOB->IDR&10111<<5;
                            k--;
                        }
           if(flag_debounce!=0){
                  for(int i=0;i<4;i++){ //scan keypad from first column
                      position_c=i+8;
                      if(i==3)position_c++;
                //set PA8,9,10,12(column) low and set pin high  from PA8
                 GPIOA->ODR=(GPIOA->ODR&0xFFFFE8FF)|1<<position_c;
                  for(int j=0;j<4;j++){ //read input from first row
               position_r=j+5;
                if(j==3) position_r++;
                 flag_keypad_r=GPIOB->IDR&1<<position_r;
        if(flag_keypad_r!=0)display(Table[j][i]);
                  }                          }             }
```

```
void keypad_init()
{
       // SET keypad gpio OUTPUT //
             RCC->AHB2ENR = RCC->AHB2ENR|0x2;
           //Set PA8,9,10,12 as output mode
             GPIOA->MODER= GPIOA->MODER&0xFDD5FFFF;
           //set PA8,9,10,12 is Pull-up output
             GPIOA->PUPDR=GPIOA->PUPDR|0x1150000;
           //Set PA8,9,10,12 as medium speed mode
             GPIOA->OSPEEDR=GPIOA->OSPEEDR|0x1150000;
           //Set PA8,9,10,12 as high
             GPIOA->ODR=GPIOA->ODR|10111<<8;

       // SET keypad gpio INPUT //
            //Set PB5,6,7,9 as INPUT mode
             GPIOB->MODER=GPIOB->MODER&0xFFF303FF;
            //set PB5,6,7,9 is Pull-down input
             GPIOB->PUPDR=GPIOB->PUPDR|0x8A800;
            //Set PB5,6,7,9 as medium speed mode
             GPIOB->OSPEEDR=GPIOB->OSPEEDR|0x45400;
}
```