Name: _____ Student ID: _____ Date: _____
Name: _____ Student ID: _____

Worksheet #11
Interfacing Input Devices

Objectives

- Understand the structure of GPIO in ARM processor
- Comprehend a technique for input devices interfacing
- Apply the C language to program GPIO in ARM processor

1. Connect 2 LEDs and 2 switches to the LPC2388 board as shown in Figure 11.1. (**Do not forget** to connect the ground terminal of LED and SW. to the ground terminal of the board).

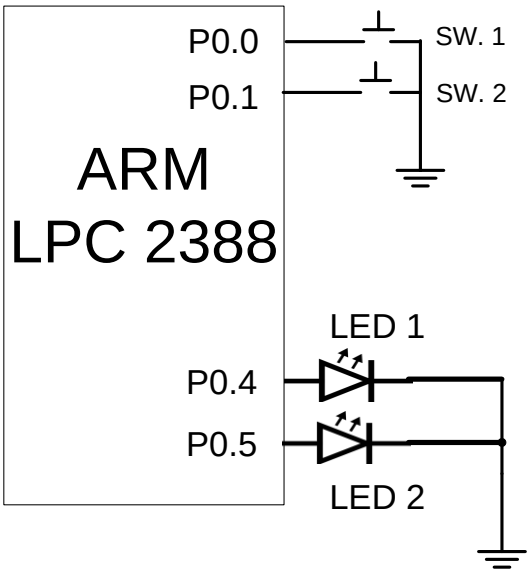


Figure 11.1

2. Create a new project and add **the startup file** to the project, then type and add Program 11.1 to the project.
3. Build the program in order to create a HEX file.
4. Connect a computer and the LPC2388 board using the USB-RS232 cable.
5. Transfer the program in HEX file format to the board using the Flash Magic program.
6. Observe the result and answer the following questions.

   Press SW. 1 and SW. 2 several times. What does the program do?

_____
_____
_____

```
#include <LPC23xx.h>
int  main(void) {
     unsigned int  P0_0 = (1 << 0);     // 00…0000001
     unsigned int  P0_1 = (1 << 1);     // 00…0000010
     unsigned int  P0_4 = (1 << 4);     // 00…0010000
     unsigned int  P0_5 = (1 << 5);     // 00…0100000

     IODIR0 =  P0_4  | P0_5;            // use p0.4 and p0.5 as output pins
     IOCLR0 =  P0_4 | P0_5;             // clear 2 LEDs

while (1) {
         if((IOPIN0 & P0_0) == 0) {             // check sw.1's status
            IOSET0 = P0_4;
          } else {
            IOCLR0 = P0_4;
          }

          if((IOPIN0 & P0_1) == 0) {            // check sw.2's status
              IOSET0 = P0_5;
          } else {
              IOCLR0 = P0_5;
          }
    }
}
```

Program 11.1

7. From Figure 11.1, write a C program that do a task as follows:

Pressing SW. 1 will turn on LED 1 and 2 simultaneously while SW. 2 will turn off these 2 LEDs.

Program

8. Connect 7-SEG Display to port P1.24 to P1.31 of LPC2388 board as shown in Figure 11.2. (**Do not forget** to connect the common pin of 7-SEG with the ground terminal of the board).

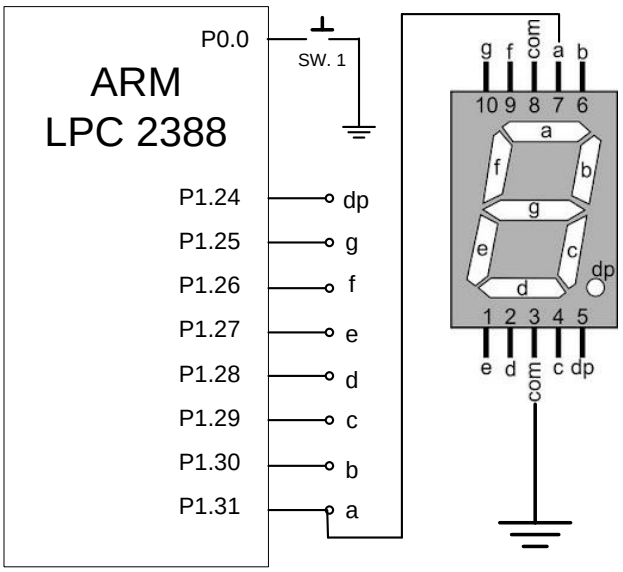


Figure 11.2

9. Create a new project and add **the startup file** to the project, then type and add the following code to the project.

```
#include <LPC23xx.h>

int  main(void) {
  unsigned int  P1_24TO31 = 0xFF000000;
  unsigned int  P0_0  =  0x1;
  int   Counter = 0,  d;

  IODIR1 =  P1_24TO31;
  IOCLR1 = P1_24TO31;

  while(1)  {
```

```
if((IOPIN0 & P0_0) == 0) {

     Counter++;

      if(Counter == 9)  Counter = 0;
}
```

```
        switch(Counter) {
           case 0 : IOSET1 = 0xFC000000; break;
           case 1 : IOSET1 = 0x60000000; break;
           case 2 : IOSET1 = 0xDA000000; break;
           case 3 : IOSET1 = 0xF2000000; break;
           case 4 : IOSET1 = 0x66000000; break;
           case 5 : IOSET1 = 0xB6000000; break;
           case 6 : IOSET1 = 0xBE000000; break;
           case 7 : IOSET1 = 0xE0000000; break;
           case 8 : IOSET1 = 0xFE000000; break;
           case 9 : IOSET1 = 0xF6000000; break;
         } //end switch
      } //end while
   } //end main
```

Program 11.2

10. Build the program in order to create a HEX file.
11. Connect a computer and the LPC2388 board using the USB-RS232 cable.
12. Transfer the program in HEX file format to the board using the Flash Magic program.
13. Press SW. 1 several times then observe the result and answer the following questions.

    Is the result shown on 7-SEGs correct? Why?

_____
_____
_____
_____
_____
_____

14. Replace the bounding box in Program 11.2 with the following code fragment.

```
if((IOPIN0 & P0_0) == 0) {

    for(d = 0;  d <= 1000; d++);

    if((IOPIN0 & P0_0) == 0) {
          Counter++;
           if(Counter == 9)  Counter = 0;
    }
}
```

15. Run the program and Press SW. 1 several times then observe the result and answer the following questions.

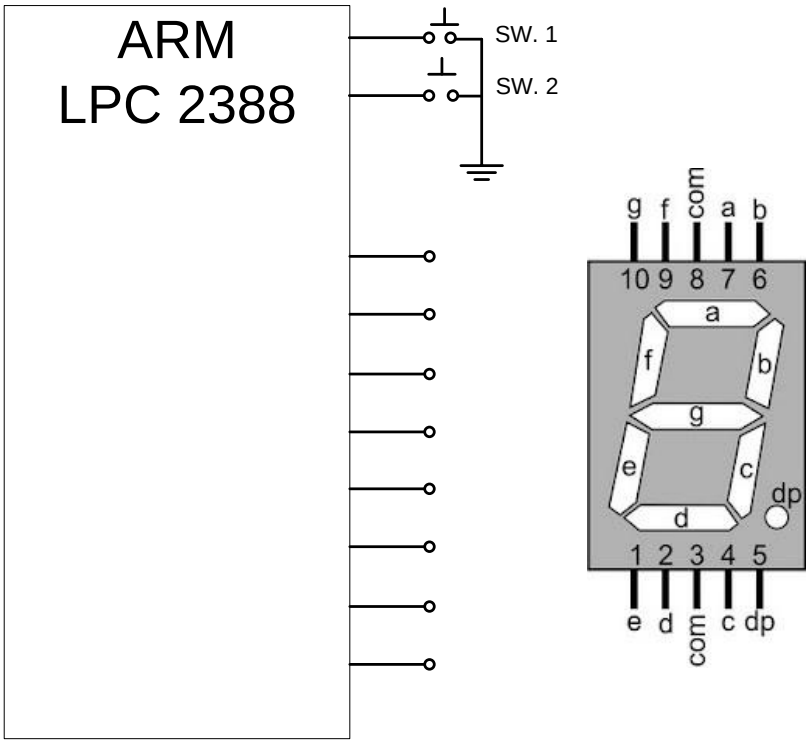
Is the result shown on 7-SEGs correct? Why?

_____
_____
_____
_____
_____
_____

16. Design a microprocessor circuit that connects two switches (SW. 1 and SW. 2) and one 7-SEG to the microprocessor's port. Then write a C program that displays the number from "0" to "9" corresponding to the switches pressing as follows:

    SW. 1 acts as an increment switch and SW. 2 as a decrement switch.

    Schematic diagram



Which port of microprocessor do you use to connect the LEDs?

_____

Program