

## **Laboratory 7: Logic Operations**

### **Problem 11:**

We want to realize a program that turns on a LED if the three buttons on RA1, RA2, RA3 are pressed at the same time.

- a. Use PORTA and the working register W. Determine a logic expression that evaluates to 0 if and only if RA1, RA2 and RA3 are pressed together.
- b. Write down a flowchart for the following program:
  - Configure PORTB as output and RA1, RA2, RA3 of PORTA as input
  - Check if RA1, RA2, RA3 are all pressed
  - Turn on the LED at RB0 for 1 s if yes
  - Turn off the LED at RB0 otherwise
- c. Write and compile the program for the flowchart in MPLAB  
Hint: Use the delay subroutine from the previous weeks.
- d. Run your code on the test card.
  - Setup the test card. Make sure that jumper JMP3 is in the LED position, JMP4 and JMP5 are in the correct position and the power cable is NOT plugged in.
  - Load your program to a PIC16F84A using the program "usburn". Place the PIC in the correct orientation!
  - Place the PIC on the test card. Place the PIC in the correct orientation!
  - Plug in the power cable.

### **Problem 12:**

We want turn on a LED if the button at either RA1 or RA3 is pressed.

- a. Which logical operation do you use now?
- b. Modify the program in Problem 11 to obtain the desired functionality.
- c. Run your code on the test card.