University of Maryland Baltimore County
Department of Computer Science and Electrical Engineering

# CMPE 212L, Principles of Digital Design Laboratory

Objective

In this laboratory, you will learn to use AND/OR gates by implementing two equal logical expressions and verifying the equivalence (same inputs in both circuits should result in same output). You need to verify that $A(B + C) = AB + AC$

Required Equipment

- 7432: which contains four 2-input OR gates? See the pin diagram for more details.
- 7408: includes four 2-input AND gates.
- LED, (10K ohms) resistors, breadboard, power supply, multi-meter, switch.

Experiments:

1. Insert both ICs in the breadboard and connect GND and Vcc according to the pin assignment (in both ICs, pin# 7 is GND and pin# 14 is Vcc).
2. First, implement A(B+C) by connecting pin# 1 and pin# 2 of 7432 to input switches. So, pin# 1 in 7432 would be signal "B" and pin# 2 would be signal "C" and pin# 3 would contain B+C.
3. Connect pin# 1 of 7408 to an input switch that we call hereafter as "A" signal. Connect Pin# 3 of 7432 to be the other input of 7408. Now, the overall output (pin# 3 of 7408) equals A(B+C). Connect pin# 3of 7408 to an LED.
4. To implement the right side of the equation you need to calculate AB and AC separately and then OR them together. So, connect the "A" and "B" signals (input switches) to pin# 4 and 5 of 7408 respectively. So pin# 6 would be AB.

5. The next step is to calculate AC by connecting the "A" and "C" signals (input switches) to the other 2-input AND gate on 7408, i.e., by connecting the "A" signal to pin# 13 and "C" signal to pin# 12, which makes pin# 11 to be AC.
6. Now that you have both AC and AB, you need to perform OR by connecting pin# 6 and pin# 11 of 7408 to pins 4 and 5 of 7432 respectively. As a result, pin# 6 of 7432 would be AC+AB, which is the desired output. Connect pin# 6 of 7432 to the LED.
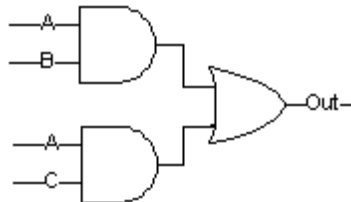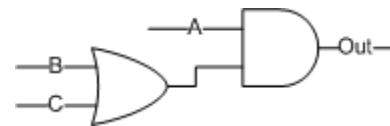
7. For all input combinations, compare the two outputs (pin# 6 of 7432 and pin# 3 of 7408) and ensure that they match. You can also test by connecting the input lines to square waves.

8. (Optional) Try to make a circuit for more complicated functions such as AB(C+D) = ABC + ABD. 74LS11 is triple 3-input AND gate.
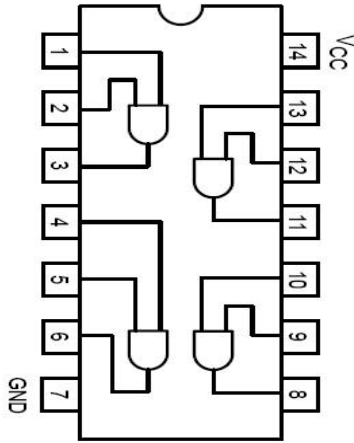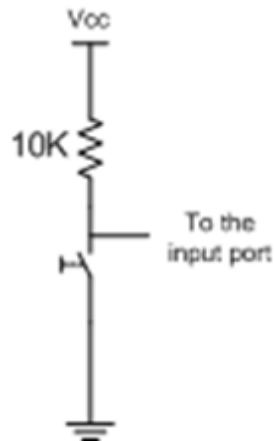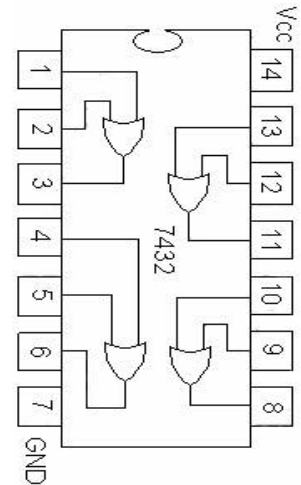

Figure 1 - 7408 Pin Assignment

Figure 2 – The Switch's Circuit

Figure 3 - 7432 Pin Assignment