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

CMPE 212L, Principles of Digital Design Laboratory

Experiment #2 Friday 2/5/2016

Objective

In this laboratory, you will learn how to use a datasheet, the integrated circuit, and the concept of binary codes by converting them to their decimal equivalent.

New Concepts:

- Integrated Circuit: An Integrated Circuit (also called chip) is an electronic circuit including thousands of millions small transistors, op-amps, capacitors, resistors, and etc. all located on a semiconductor wafer.
- Datasheet**:** Is the chip's catalogue containing the device's technical characteristics including pin assignment, logic diagram, truth table, and operating details provided by the manufacturer.

Required Equipment

- Decoder: a device that converts a number's binary notation to its decimal equivalent.
- Switch: a digital key that allows switching the input port between "0" and "1".
- LED, (330, 1K ohms) resistors, breadboard, power supply, multi-meter.

Experiments:

1. Connect the decoder to the breadboard and wire GND and V_{cc} pins according to the pin assignment (Figure 1).
2. Enable the chip by holding the enable input G1 high and enable inputs $\bar{G}2A$ and, $\bar{G}2B$ low; otherwise, the chip is disabled and decoding function is inhibited so that all outputs go high. (G1, $\bar{G}2A$, and $\bar{G}2B$ are used as address decoder in memory systems to ease cascade connections).
3. Connect input ports to both GND and V_{cc} by the use of a switch circuit (Figure 2).
4. Connect Output ports to the voltage indicator circuits.
5. Verify the circuit's functionality by examining all possible input states and compare with the truth table (Table 1).
6. For input = 011, reduce voltage of A, B inputs by small degrees and find the minimum voltage in which the circuit still functions correctly.

Figure 2 – The Switch's Circuit

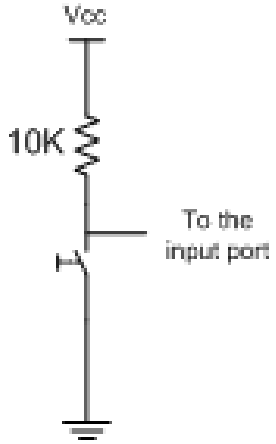

Figure 1 - 74138 Pin Assignment

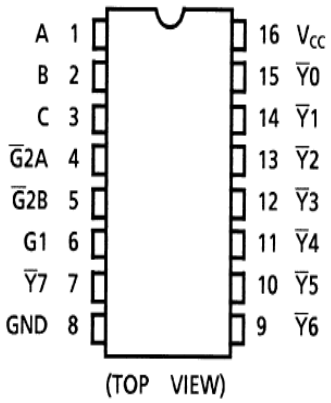

Table 1 - 74138's Truth Table

Inputs						Outputs							
Enable			Select										
$G1$	$\overline{G}2B$	$\overline{G}2A$	C	B	A	$\overline{Y}0$	$\overline{Y}1$	$\overline{Y}2$	$\overline{Y}3$	$\overline{Y}4$	$\overline{Y}5$	$\overline{Y}6$	$\overline{Y}7$
H	L	L	L	L	L	L	H	H	H	H	H	H	H
H	L	L	L	L	H	H	L	H	H	H	H	H	H
H	L	L	L	H	L	H	H	L	H	H	H	H	H
H	L	L	L	H	H	H	H	H	L	H	H	H	H
H	L	L	H	L	L	H	H	H	H	L	H	H	H
H	L	L	H	L	H	H	H	H	H	H	L	H	H
H	L	L	H	H	L	H	H	H	H	H	H	L	H
H	L	L	H	H	H	H	H	H	H	H	H	H	L