Experiment Number -02

PEC-101/201 Fundamental of Electronics Engineering Lab
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OBJECT

To study the Logic Gates (AND, OR, NOT and EX-OR)

APPRATUS REQUIRED

1. Logic Gates Kit.
2. Connecting Probes (Leads).
3. Power Supply

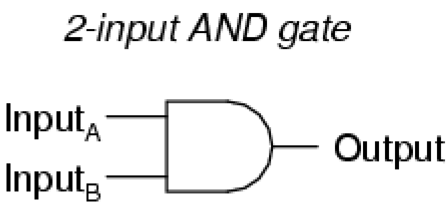
THEORY

1. AND GATE

The output state of a "Logic AND Gate" only returns "LOW" again when **ANY** of its inputs are at a logic level "0". In other words for a logic AND gate, any LOW input will give a LOW output. The logic or Boolean expression given for a digital logic AND gate is that for *Logical Multiplication* which is denoted by a single dot or full stop symbol, (.) giving us the Boolean expression of: A.B = Y.

Then we can define the operation of a 2-input logic AND gate as being:

"If both A and B are true, then Y is true"



A	B	Output
0	0	0
0	1	0
1	0	0
1	1	1

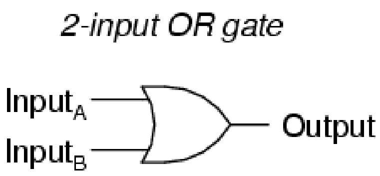
2. OR GATE

The output, Q of a "Logic OR Gate" only returns "LOW" again when **ALL** of its inputs are at a logic level "0". In other words for a logic OR gate, any "HIGH" input will give a "HIGH", logic level "1" output.

The logic or Boolean expression given for a digital logic OR gate is that for *Logical Addition* which is denoted by a plus sign, (+) giving us the Boolean expression of: A+B = Y.

Then we can define the operation of a 2-input logic OR gate as being:

"If either A or B is true, then Y is true"



A	B	Output
0	0	0
0	1	1
1	0	1
1	1	1

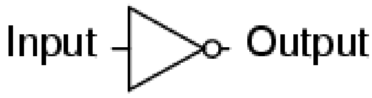
3. NOT GATE

It is a single input device which has an output level that is normally at logic level "1" and goes "LOW" to a logic level "0" when its single input is at logic level "1", in other words it "inverts" (complements) its input signal. The output from a NOT gate only returns "HIGH" again when its input is at logic level "0" giving us the Boolean expression of: $\overline{A} = Y$.

Then we can define the operation of a single input digital logic NOT gate as being:

"If A is NOT true, then Y is true"

NOT gate truth table



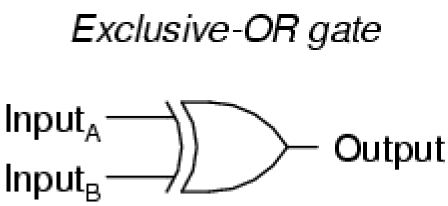
Input	Output
0	1
1	0

4. EX-OR GATE

This ability of the *Exclusive-OR gate* to compare two logic levels and produce an output value dependent upon the input condition is very useful in computational logic circuits as it gives us the following Boolean expression of:

$$Y = (A \quad B) = A.B + A.B$$

The logic function implemented by a 2-input Ex-OR is given as either: "A OR B but NOT both" will give an output at Q. In general, an Ex-OR gate will give an output value of logic "1" ONLY when there are an **ODD** number of 1's on the inputs to the gate, if the two numbers are equal, the output is "0".



A	B	Output
0	0	0
0	1	1
1	0	1
1	1	0

Then an Ex-OR function with more than two inputs is called an "odd function" or modulo-2-sum (Mod-2-SUM), not an Ex-OR. This description can be expanded to apply to any number of individual inputs as shown below for a 3-input Ex-OR gate.

PROCEDURE

Make connections on the Logic Gates Kit and verify the truth table for each logic gate.

RESULT

Successfully studied the Logic Gates and verified the truth table for each Logic Gates.

DISCUSSION

Concept of the digital logic gates is cleared after performing this experiment.

PRECAUTIONS

1. Connections should be proper and tight.
2. Switch "ON" the power after completing the circuit.
3. Carefully read the Logic "High" and Logic "Low" condition.