زانکۆی گەشەپێدانی مرۆیی
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Experiment No. (2)

Boolean Laws & Demorgan's Theorem

Objectives:

After completing this experiment, you will be able to:

1- Use TTL logic verify experimentally whether several of rules for Boolean algebra.
2- Experimentally determine the truth table for circuits with three input variables and use demorgan's theorem to prove algebraically whether they are equivalent.

Ic's Needed:

(7432) quad 2 – input OR gate.

(7404) inverter.

(7408) quad 2 – input AND gate.

Theory:

Boolean algebra consists of a set of laws that have logical relationships. Unlike ordinary algebra, where an unknown can take any value, the elements of Boolean algebra are binary variables and can have only one of two valves: 1 or 0 (also called **TRUE** or **FALSE**). Variables are typically letters of the alphabet.

Symbols used in Boolean algebra include the bar which is **NOT** or complement the connective **(+)**, which implies logical addition and is read "**OR**" and the connective **(.)** Which implies logical multiplication and is read "**AND**". The dot is frequently

eliminated when logical multiplication is shown. This A**.**B is written AB. The basic rules of Boolean algebra are shown in table (2-1).

1.	A+0=A
2.	A+1=1
3.	A.0=0
4.	A.1=A
5.	A+A=A
6.	$A+\bar{A}=1$
7.	A. A = A
8.	$A. \bar{A} = 0$
9.	$\bar{\bar{A}} =A$
10.	A + AB = A
11.	$A + \bar{A} B = A+B$
12.	(A+B)(A+C)=A+BC

Table (2-1) basic rules of Boolean algebra.

NOT: A.B or C can represent a single variable or combination of variable.

In this experiment you will use **TTL** logic to become familiar with this important family. There are several subfamilies of **CMOS** which have different specification. The original **CMOS** family was the 4000 a series. Other families include the 54C / 74C family, which is functionally, and pin-out-compatible with TTL 54/74 series, and the 54HC / 74HC, which is functionally and pin-out-compatible with TTL 54LS / 74LS logic. The 54C / 74C series is faster and can sink 50% more current that the 4000 series.

One disadvantage of **CMOS** is that it is damaged more easily that **TTL**. Because the **TTL** (**T**ransistor-**T**ransistor **L**ogic) is the most widely used logic family. Almost

every major manufacturer has a **TTL** product line and most common **TTL** integrated circuits are produced by several companies. So we will use **TTL** logic in this experiment.

Procedure:

Part I: Boolean Rules

1- Prove rule 1 (see table 2-1) with the circuit of Fig. (2-1). Use 5.0V for the power supply. Set the generator for a frequency of 10KHZ with 0V to 4V level on the output. Sketch the input signal. V in and voltage on your sketches. To obtain the proper time relationship between signals, look at both signals at one time on the scope while triggering on one channel only.

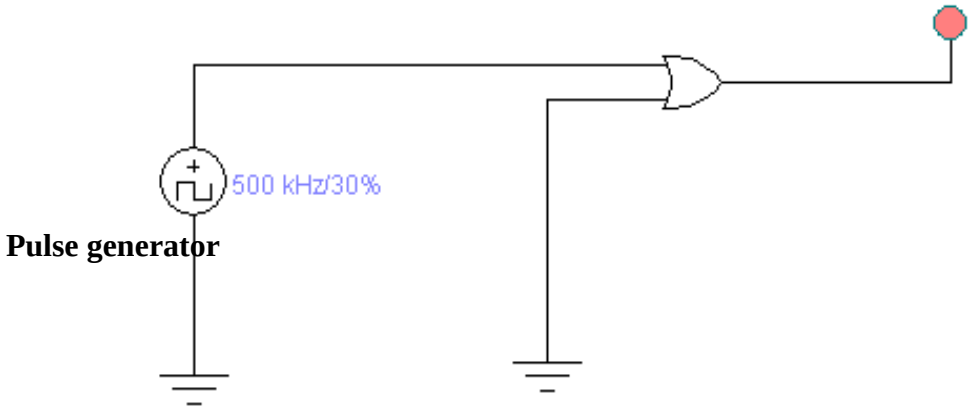

Fig. (2-1) OR-gate that implement rule (1)

2- Change the circuit to that of Fig. (2-2) Sketch the input and output signals.

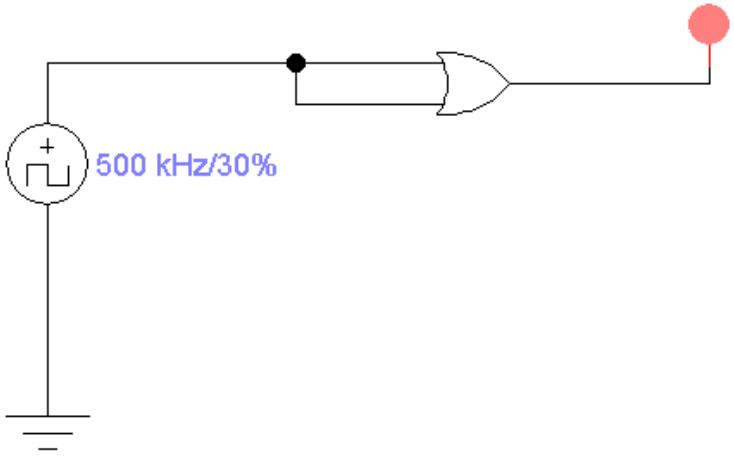

Fig. (2-2) OR-gate that implement rule (5)

3- Connect the circuit of Fig. (2-3) Sketch the input and output signals. Which rule does this circuit illustrate?

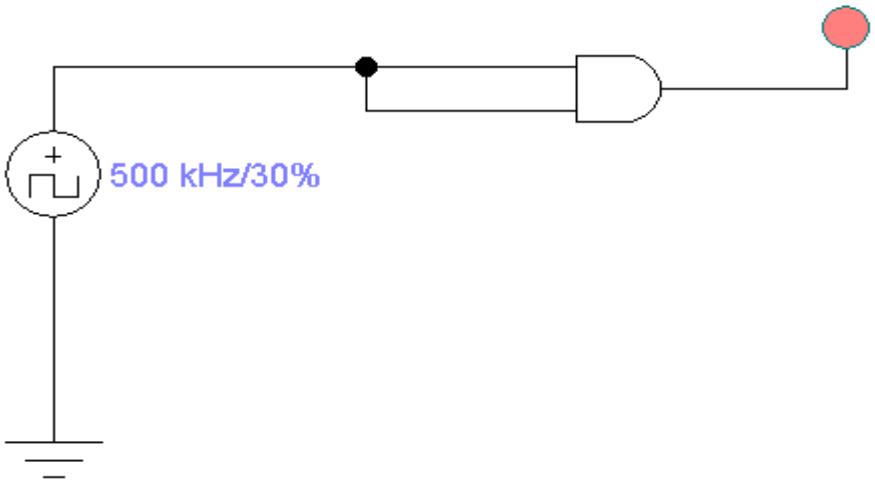

Fig. (2-3) AND-gate that implement rule??

4- Design a circuit that illustrates rule 10. Use the signal generator for A and a switch (or wire) for B. Sketch the A input and output signal. Does B affect the output?

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