Al-Mamoon University

College of Science

Department of Medical Physics

EX (3):

NOT and NAND GATE

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NOT GATE

The purpose of the experiment

Learn about the function of the NOT gate by using transistor BJT.

Gate symbol

It is as shown in the figure below:

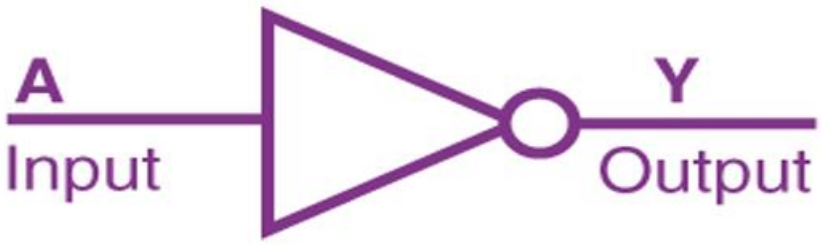


Figure 1

Number of possibilities

following relationship:

number of possibilities = 2^n

where (n) is the number of entries.

Logical equation:

$$Y = \overline{A}$$

Physical Principle

This gate is called the inverter gate, and it contains one input and one output. The truth table is as shown in the table below:

Input	Output
A	Y
0	1
1	0

The electrical circuit of the (NOT) gate can be represented in the figure below, as we note that the lamp is connected in parallel with the battery and it is in the

OFF state when one key is closed, the other way around the lamp is ON if the switch is opened.

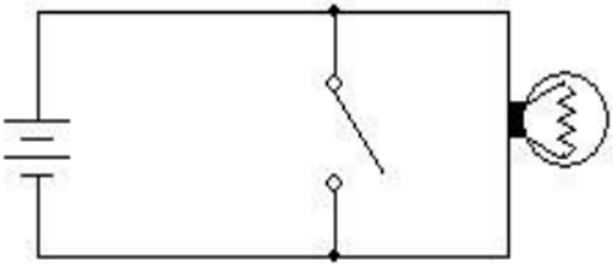


Figure (2)

A (NOT) gate can be obtained using a transistor, as shown in Figure (3), in the case in which (R_B) is connected to (+5V), that is, the logical state of the input A (1), then the transistor operates in (saturation region) and current passes in the collector circuit ($I_{C\,max}$) and thus be (V_{CE}), which is (V_O), which is approximately equal to (= 0.2V), (meaning that the lamp (Y) is in the state of (OFF) and its logical state is (0), but in the case in which (R_B)) reached ground i.e. the logical state of the input is (0), then the transistor will be in the (cut state) and then no current passes through the collector circuit, so it will be (V_O=5V), meaning that the lamp is on (ON) state, and thus the logical state of the output is (1).

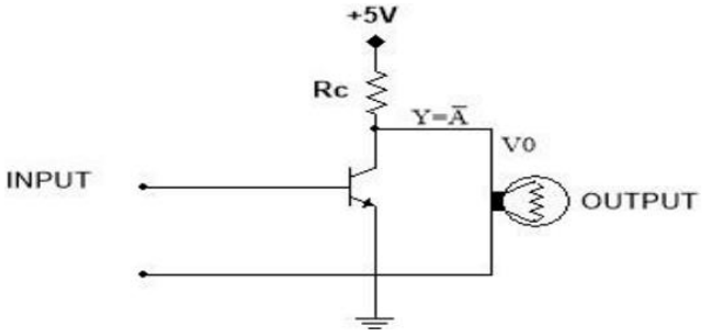


Figure (3)

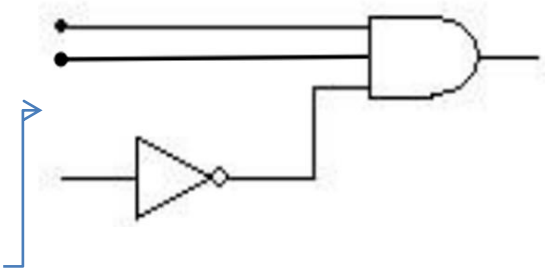
procedure

1) Connect the circuit in Figure (3).

2) Realize the truth table.

Discussion

Find the truth table for the following logical circuit:



NAND GATE

The purpose of the experiment

1. Realization of NAND gate using DTL circuit.

2. Realization of NAND gate using IC-7400 circuit

Gate symbol

It is as shown in the figure below:

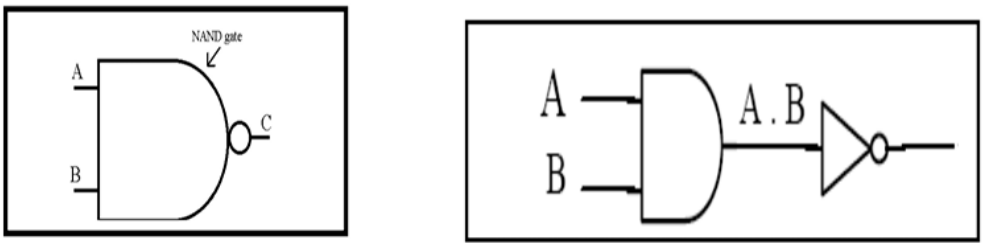


Figure (1)

Logical equation:

$$Y = \overline{A.B}$$

Physical Principle

A NAND gate consists of an AND gate followed by a NOT gate as seen from the logic symbol for the gate in Figure (1), the truth table for this gate is:

A	B	Q
0	0	1
0	1	1
1	0	1
1	1	0

Figure 2

It is possible to build a NAND gate using a circuit (Diode-Transistor Logic DTL), which is diodes and transistors circuit, as shown in Figure (3)

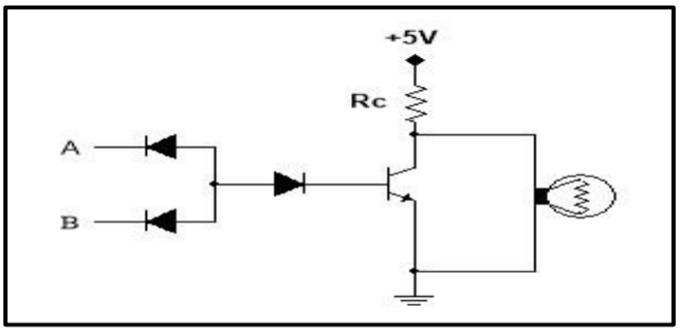


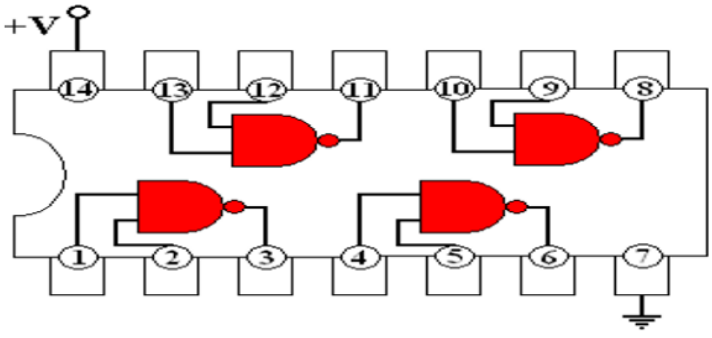
Figure (3)

Evaluation and results

1. If one or all of the inputs are in the logical state (0), then current will pass through D1, D2 , and thus V_Y is not enough to make the diode connected to the base of the transistor is in the conducting state, that is Y = 0 .

2. If all the inputs are in the logical state (1), then the diodes D1, D2 will be in the state of reverse bias so V_Y is sufficient to make the diode connected to the base of the transistor is in the conducting state and therefore $I_{C\ max}$ the can pass through the transistor, that is Y = 0 .

3. It is possible to obtain a NAND gate using the IC-7400 chip and it contains four NAND gates with two inputs, as shown in Figure (4).



4. Connect the circuit shown in Figure (3).

5. Connect the lamp or LED to the location of .

6. Realize the truth table of the two-input NAND gate.

7. Connect the circuit shown in Figure (4), connect the lamp or LED to Pin3.

8. Realize the truth table