DIGITAL LOGIC AND DESIGN LAB

PROJECT :1

(Section: B5)

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Logic gates: Logic gates are used to carry out logical operations on single or multiple binary inputs and give one binary output. In simple terms, logic gates are the electronic circuits in a digital system.

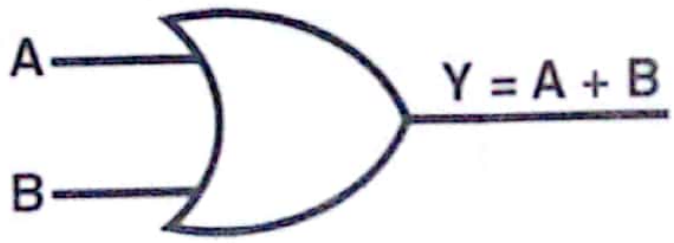
Types of Logic Gates:

There are several basic logic gates used in performing operations in digital systems. The common ones are

- OR Gate
- AND Gate
- NOT Gate
- XOR Gate

Additionally, these gates can also be found in a combination of one or two. Therefore, we get other gates, such as NAND Gate, NOR Gate, EXOR Gate and EXNOR Gate.

OR Gate:



Working:

The OR gate produces a HIGH output (1) if any of its inputs are HIGH (1). The output is LOW (0) only when all inputs are LOW

Boolean Expression:

Y = A + B

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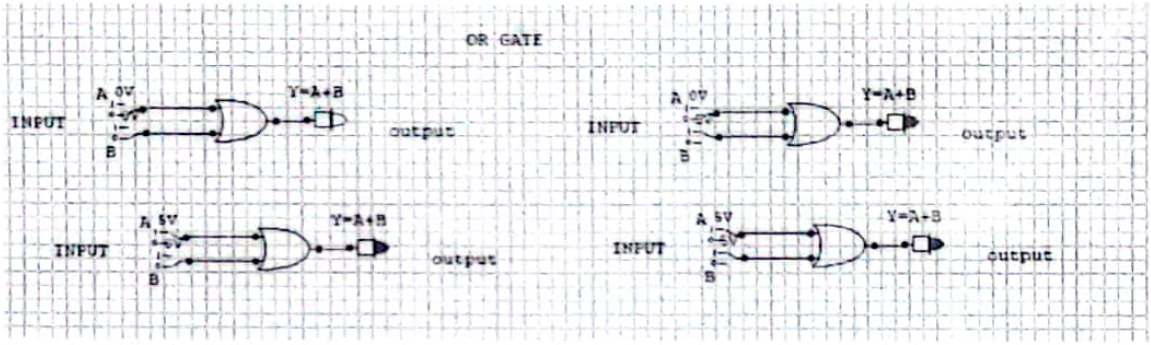
Truth Table:

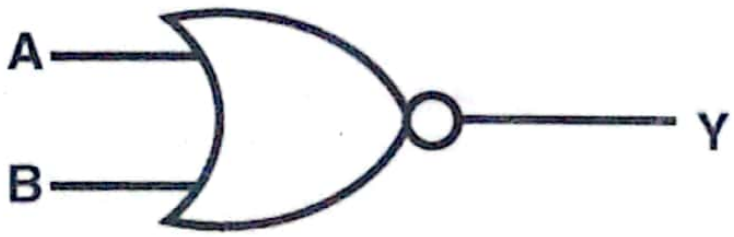
A	B	Y
0	0	0
0	1	1
1	0	1
1	1	1

VERIFICATION



Nor Gate:

This gate is the combination of OR and NOT gates.



:

Boolean expression:

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

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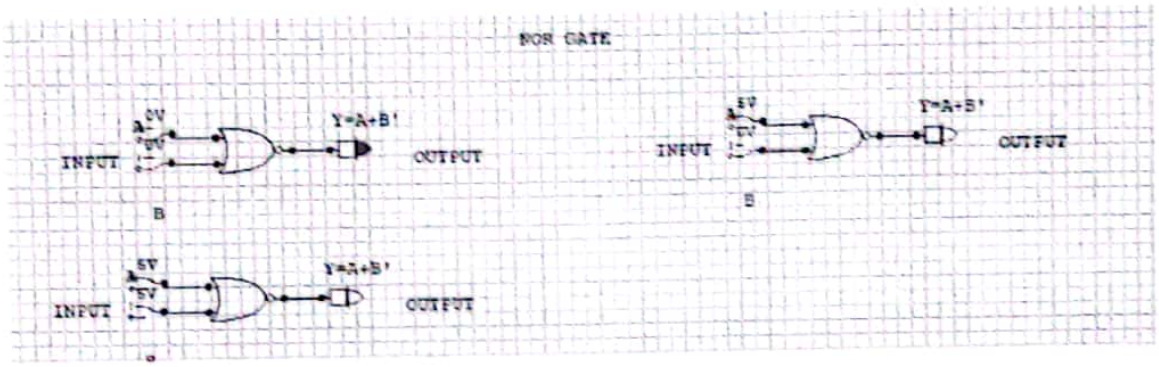
Truth Table:

A	B	Y
0	0	1
0	1	0
1	0	0
1	1	0

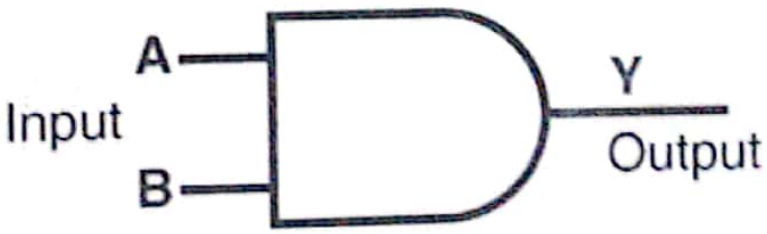
VERIFICATION



Working:

The NOR gate is the inverse of the OR gate. It produces a HIGH output (1) only when all of its inputs are LOW (0). Otherwise, it produces a LOW output (0).

AND GATE:



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Boolean Expression:

$Y = A.B$

Truth Table:

A	B	Y
0	0	0
0	1	0
1	0	0
1	1	1

VERIFICATION

Working:

The AND gate produces a HIGH output (1) only when all of its inputs are HIGH (1). If any input is LOW (0), the output is LOW (0).

NAND GATE:

This basic logic gate is the combination of AND and NOT gates.

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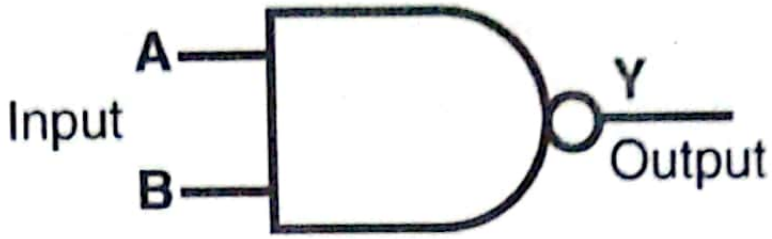


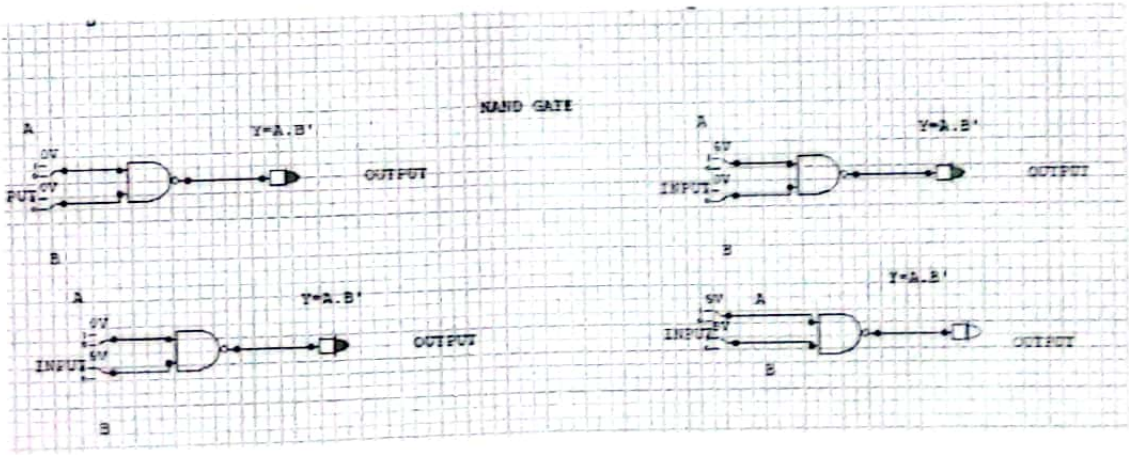
Boolean Expression:

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

Truth Table:

A	B	Y
0	0	1
0	1	1
1	0	1
1	1	0

VERIFICATION



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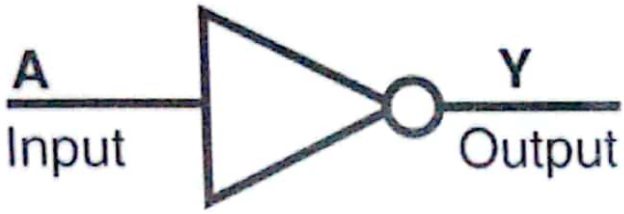
Working:

The NAND gate is the inverse of the AND gate. It produces a LOW output (0) only when all of its inputs are HIGH (1). Otherwise, it produces a HIGH output (1).

NOT GATE:



Boolean Expression:

$$Y = \bar{A}$$

Truth Table:

A	Y
0	1
1	0

VERIFICATION

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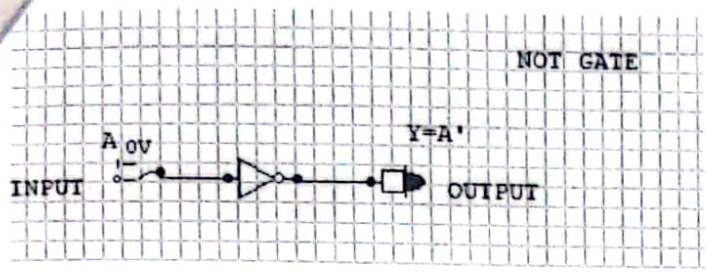
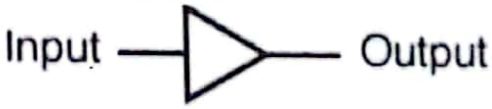


Working:

The NOT gate has a single input and inverts its value. It produces a HIGH output (1) when the input is LOW (0) and vice versa.

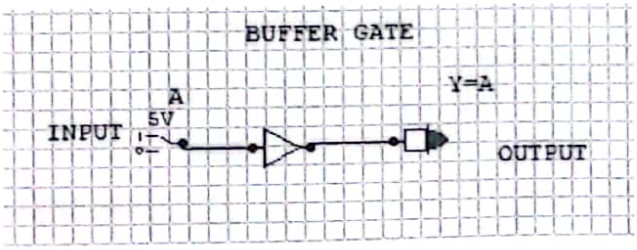
Buffer GATE:



Truth Table:

Input	Output
0	0
1	1

VERIFICATION



Working:

- A buffer gate has a single input and a single output.

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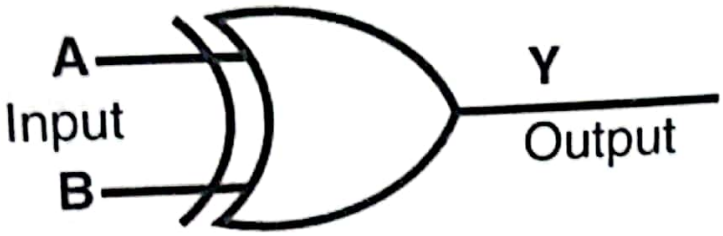
- It simply duplicates the input signal to the output without any change.
- Its main purpose is to isolate or strengthen a signal.

Exclusive-OR gate (XOR Gate):



Boolean Expression:

$A.\bar{B} + \bar{A}.B$

or

$Y = A \oplus B$

Truth Table:

A	B	Y
0	0	0
0	1	1
1	0	1
1	1	0

VERIFICATION

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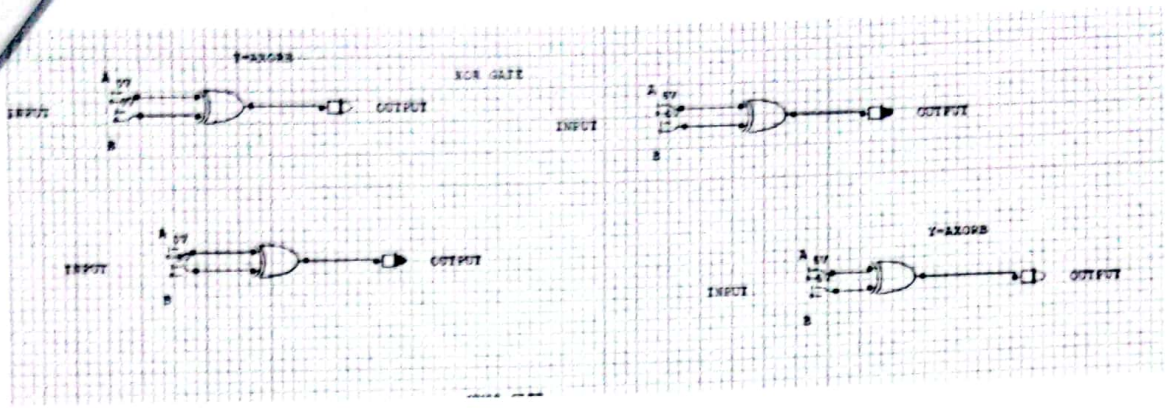
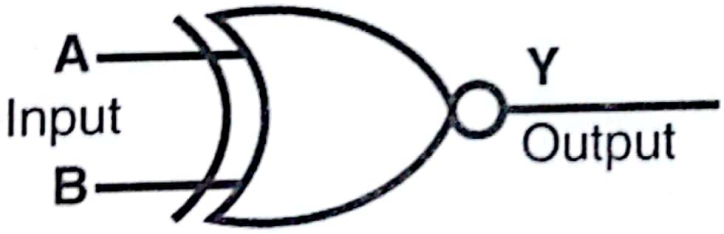


Working:

The XOR gate produces a HIGH output (1) when its inputs are different. It produces a LOW output (0) when its inputs are the same.

Exclusive-NOR Gate (XNOR Gate):



Boolean Expression:

$$Y = (\overline{A \oplus B}) = (A.B + \overline{A}.\overline{B})$$

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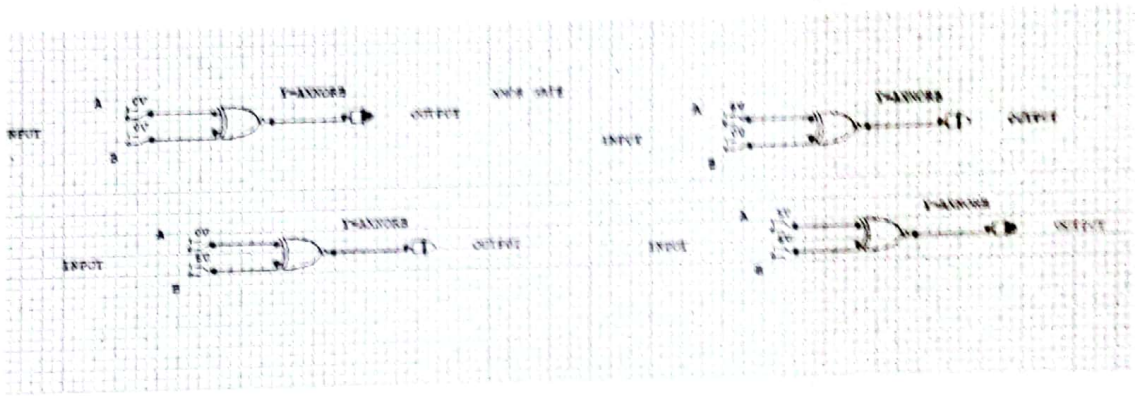
Truth Table:

A	B	Y
0	0	1
0	1	0
1	0	0
1	1	1

VERIFICATION



Working:

The XNOR gate is the inverse of the XOR gate. It produces a HIGH output (1) when its inputs are the same. It produces a LOW output (0) when its inputs are different.

Application of Logic Gates:

Logic gates have a lot of applications, but they are mainly based on their mode of operations or their truth table. Basic logic gates are often found in circuits such as safety thermostats, push-button locks, automatic watering systems, light-activated burglar alarms and many other electronic devices.

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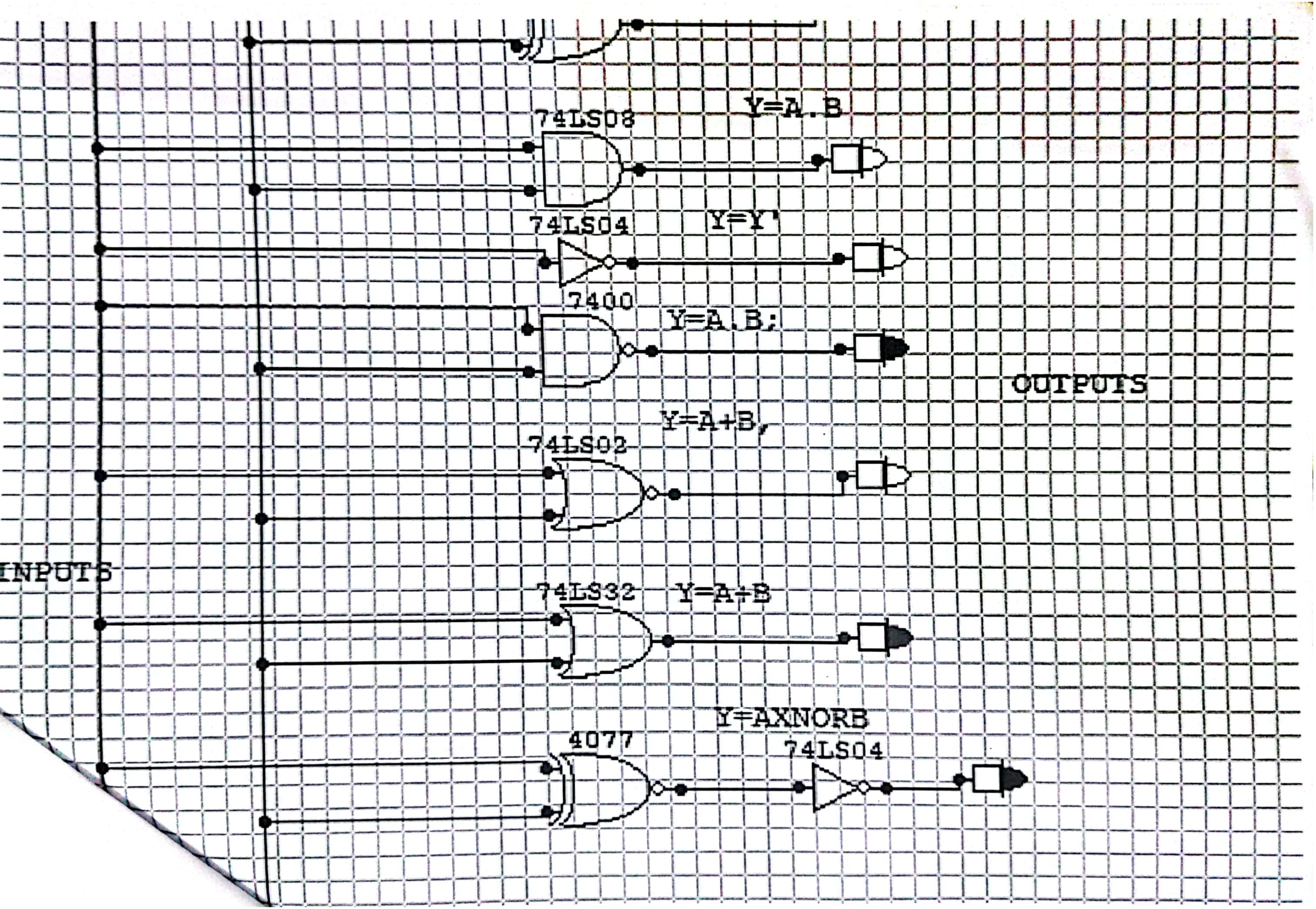

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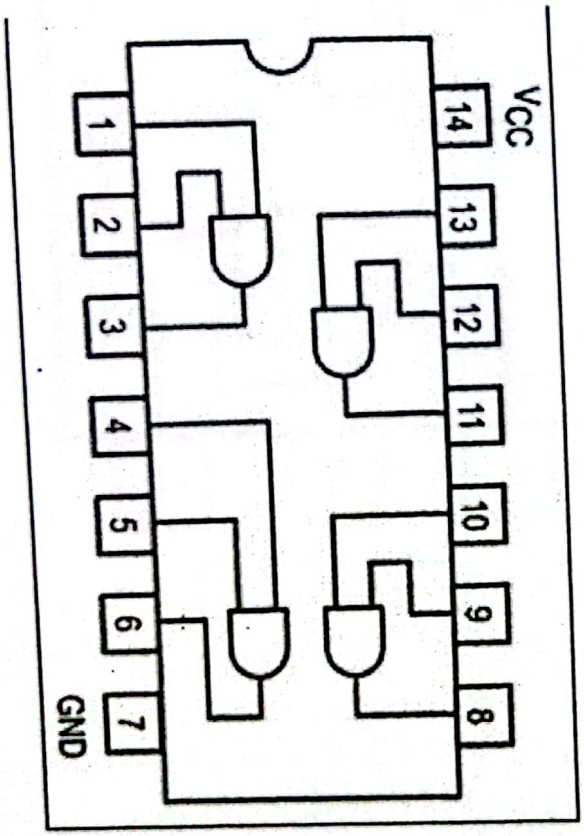
IC DIAGRAMS

AND GATE



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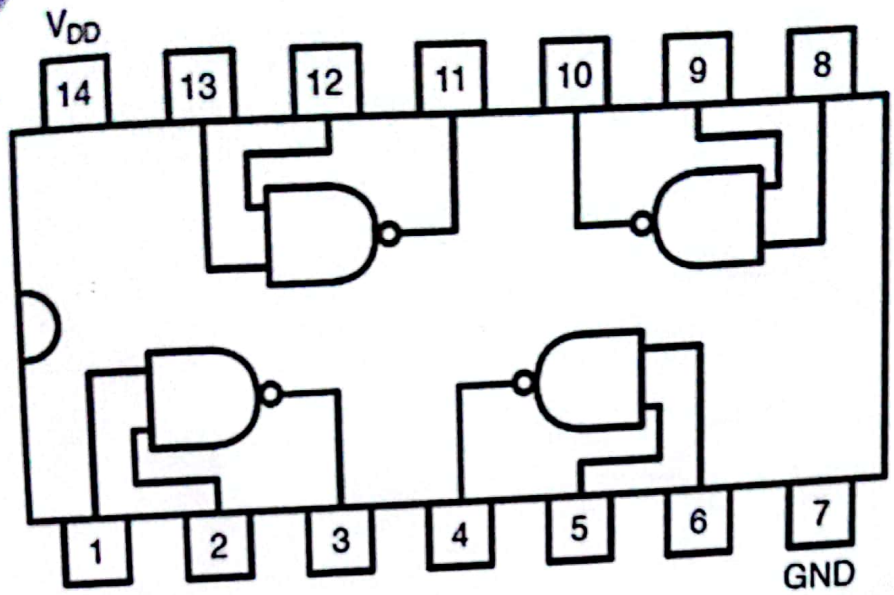

NOR GATE

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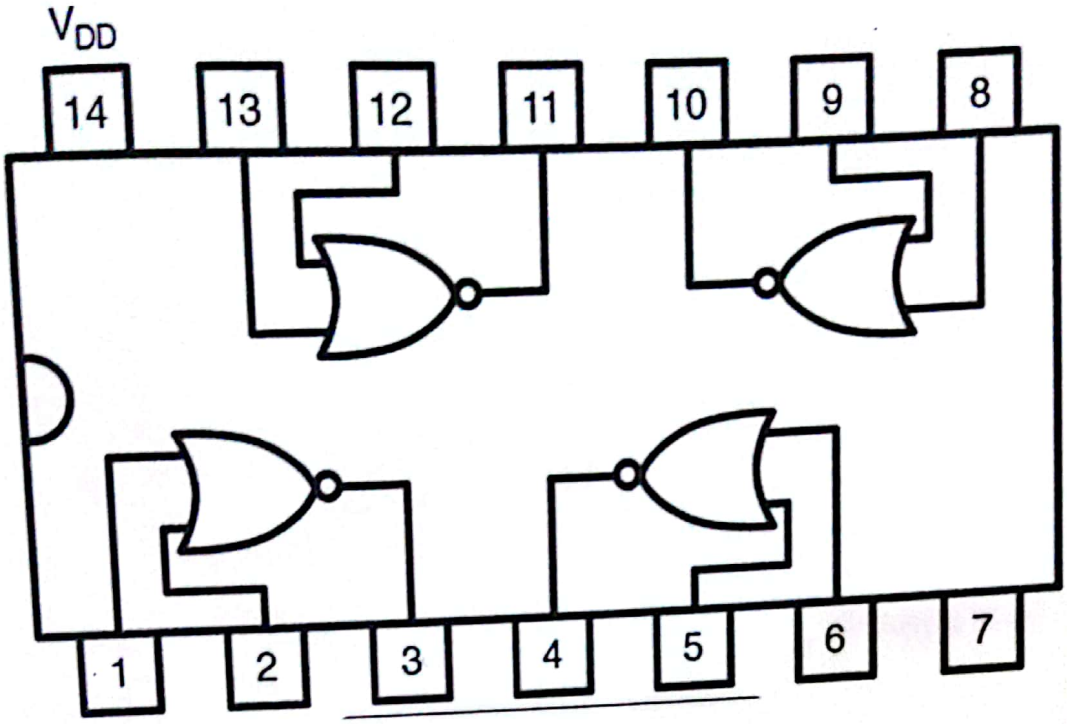
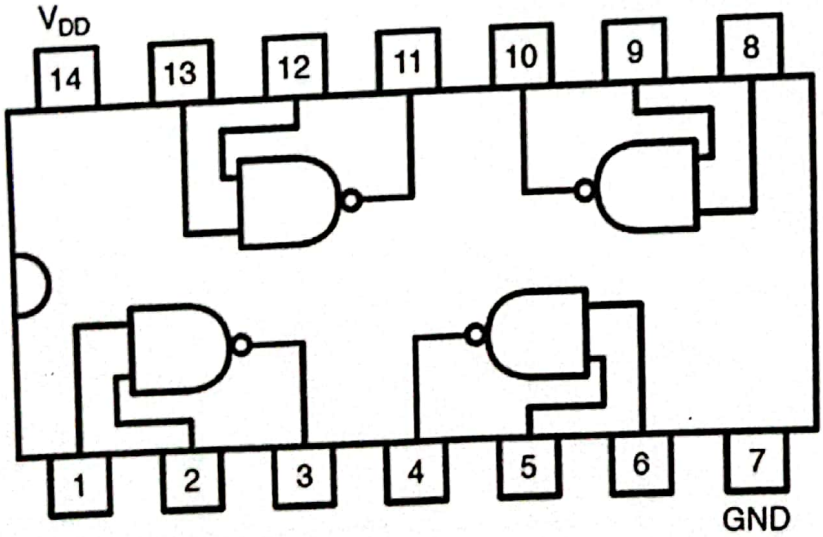


XOR GATE



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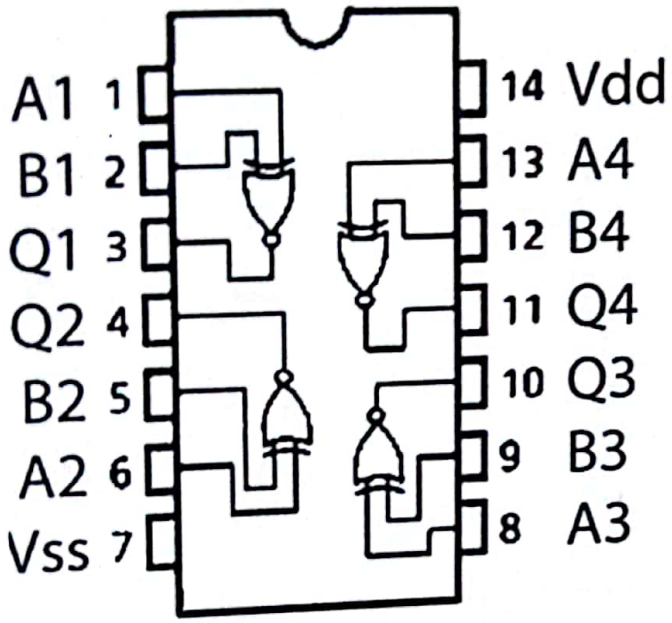
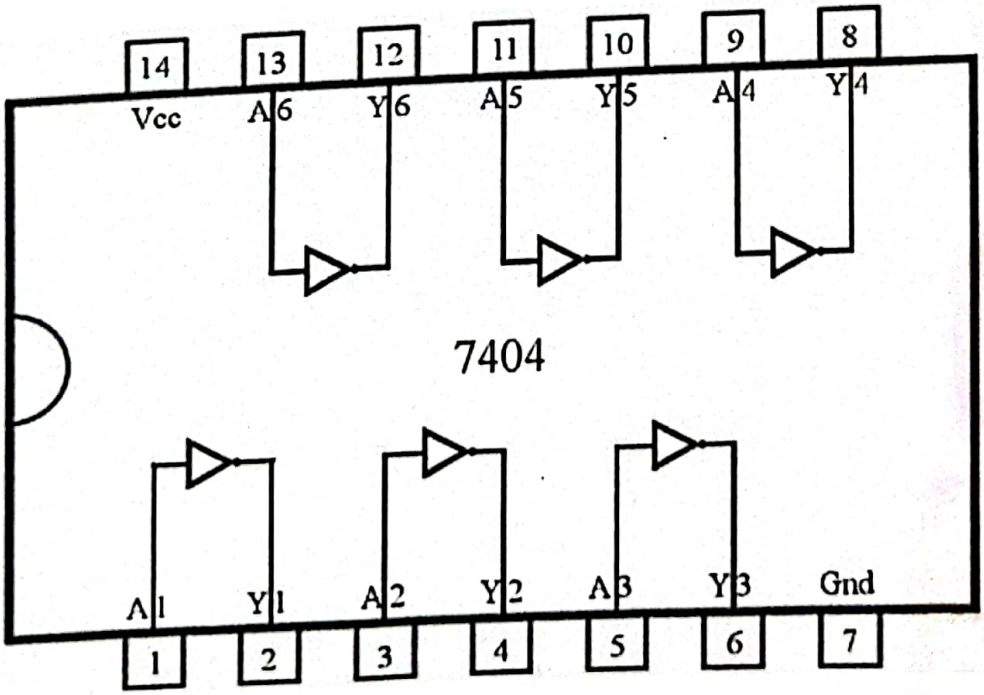
XNOR GATE



NOT GATE



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