Week-3

Cse 260

Lab Assignment - 2

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Sec: 09

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Ans:

① Name of the Experiment:

Applications of Boolean algebra

② Objective:
- To investigate the rules of Boolean algebra.
- To gain experience working with practical circuits
- To simplify a complex function using Boolean algebra.
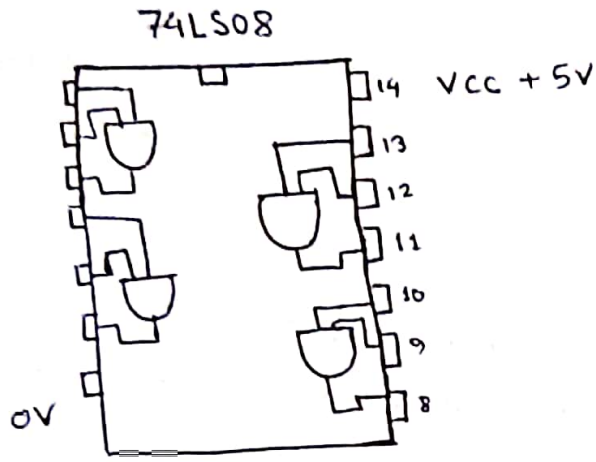
③ Required Components and Equipments

offline {
1. AT- 700 Portable Analog / Digital Laboratory
2. 7400 × 1
}

online {
1. Logic Gates (NAND gates mainly)

2. Inputs (using logic state)

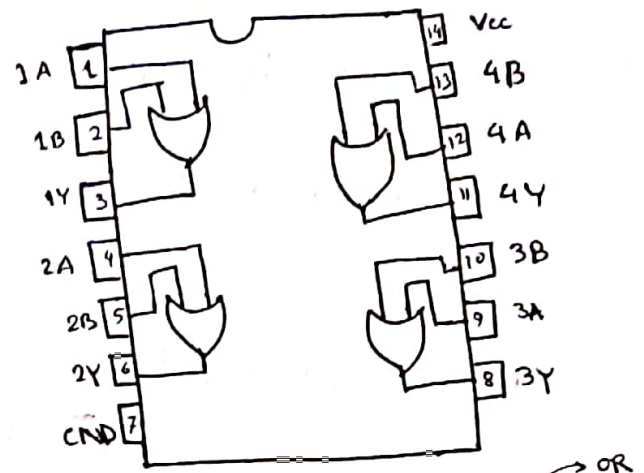3. LEDs (Blue and other colors)

4. Power Source.
}

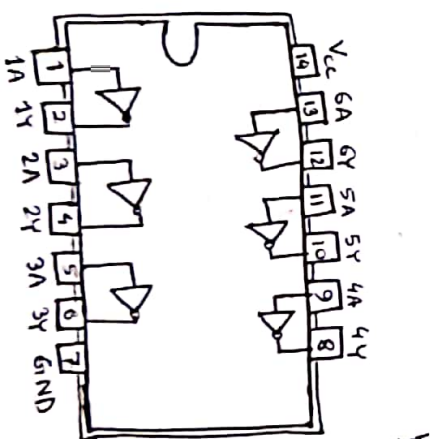Logic Gates (AND gate, NOT gate, OR gate, XOR gate, XNOR gate, NAND gate, NOR gate).

Ans no:

④ Experimental Setup:
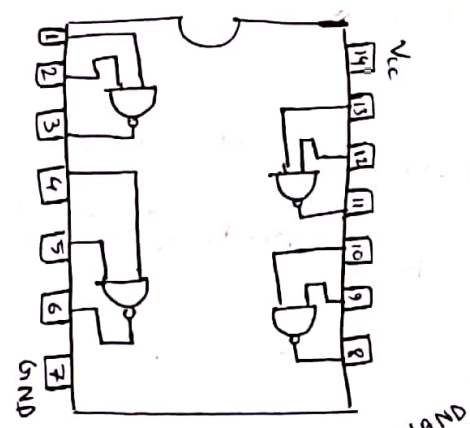
74LS08

14 VCC +5V
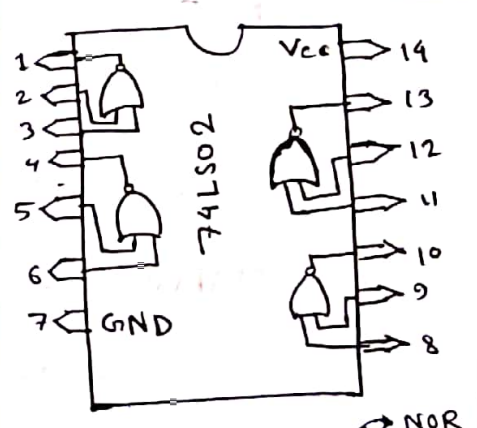
OV

Pin layout of 7408 → AND
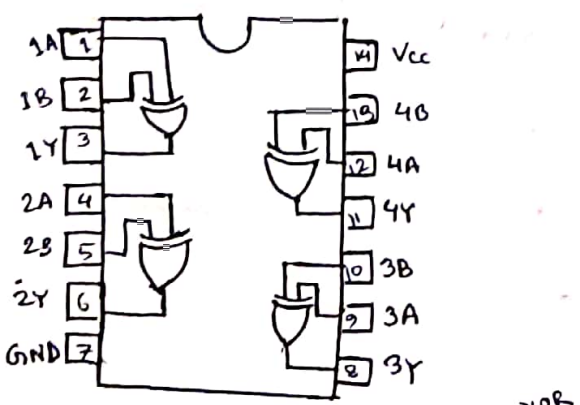

Pin layout of 7432 → OR

Pin layout of 7404 → NOT

Pin layout of 7400 → NAND

74LS02

Pin layout of 7402 → NOR

Pin layout of 7486 → XOR

Pin layout of 74 266 → XNOR
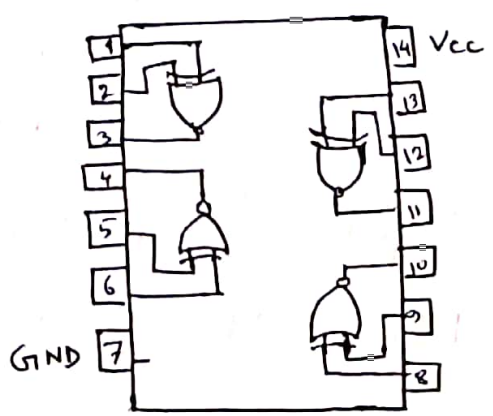
Ans no:

④ Experimental Setup:

→ NAND gate

A

$(A. (A.B)')'$

$(\dot{-}.\dot{-})$

Y

$(A.B)'$

B

$(B. (A.B)')'$
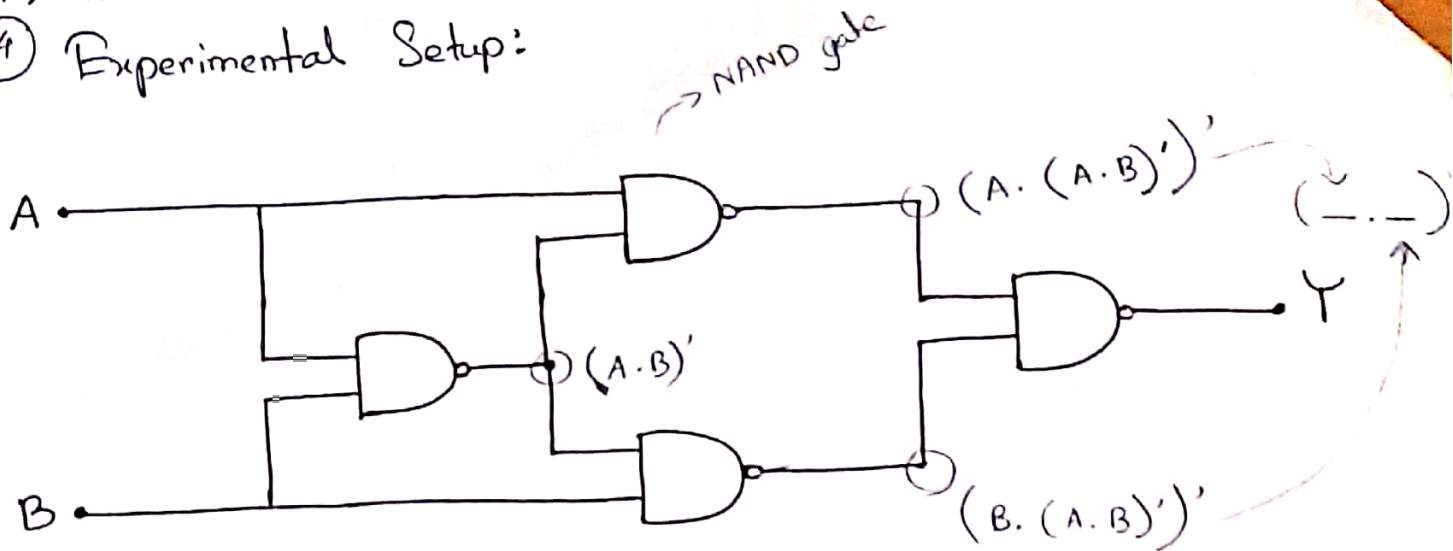
⑤ Results (Truth Table) and Discussions:

Results (Truth Table):

Input 1 A	Input 2 B	Output Y
0	0	0
0	1	1
1	0	1
1	1	0

⑤ Discussion:

• What is the Boolean Equation for the output?

⟹ 1st NAND Gate:

$$(A \cdot B)'$$

2nd NAND Gate:

$$(A \cdot (A \cdot B)')'$$

3rd NAND Gate:

$$(B \cdot (A \cdot B)')'$$

Y / Output:

$$\Big((A \cdot (A \cdot B)')' \cdot (B \cdot (A \cdot B)')'\Big)'$$

• Simplify the Boolean equation

⟹ $$\Big((A \cdot (A \cdot B)')' \cdot (B \cdot (A \cdot B)')'\Big)'$$

$$= \Big((A \cdot (A' + B'))' \cdot (B \cdot (A' + B'))'\Big)'$$

$$= \Big((A \cdot (A' + B'))' \cdot (B \cdot (A' + B'))'\Big)'$$

$$= \Big((AA' + AB')' \cdot (BA' + BB')'\Big)'$$

$$= \Big((0 + AB')' \cdot (A'B + 0)'\Big)'$$

P.T.O

$$= \left(\left(A B' \right)' \cdot \left(A' B \right)' \right)'$$

$$= \left(\left(A' + \left(B' \right)' \right)' \cdot \left(\left(A' \right)' + B' \right)' \right)'$$

$$= \left(\left(A' + B \right)' \cdot \left(A + B' \right)' \right)'$$

$$= \left(\left(\left(A' \right)' \left(B \right)' \right) \cdot A' \left(B' \right)' \right)'$$

$$= \left(A B' \cdot A' B \right)'$$

$$= \left(A A' \cdot B' B \right)'$$

$$= \left(0 \cdot B B' \right)'$$

$$= \left(0 \cdot 0 \right)'$$

$$= 0$$

$$((A \cdot (A \cdot B)')' \cdot (B \cdot (A \cdot B)')')'$$

(x·, y·)'

$$= \overline{\left(A \cdot (AB)'\right) + \left(B(AB)'\right)}$$

$$= A \cdot (A' + B') + B(A' + B')$$

$$= \left(AA' + AB'\right) + \left(BA' + BB'\right)$$

$$= \left(0 + AB'\right) + \left(BA' + 0\right)$$

$$= AB' + B \cdot A'$$

$$= A \oplus B.$$

$$(x' \cdot y')'$$

$$(x')' + (y')'$$

$$= x + y$$

→ De Morgan

$$(xy)' = x' + y'$$

2. (x + x +

$$x \cdot (y + z) = (x \cdot y) + (x \cdot z)$$

$$xx' = 0$$

$$x + x' = 1$$

• The circuit's function is identical to a single gate. Write down the name of that gate.

=> The name of that gate is XOR. The truth table from the simulation matches that with XOR truth table. Also, the function and diagram of the circuit is identical to XOR gate.