## D. Preiminary Work

1. Draw a symbol, determine the IC number and produce a truth table for the following gate.

**AND**

Symbol:


IC Number: 7408

Truth Table 1

| Input | | Output |
|---|---|---|
| A | B | F |
| 0 | 0 | 0 |
| 0 | 1 | 0 |
| 1 | 0 | 0 |
| 1 | 1 | 1 |

**NAND**

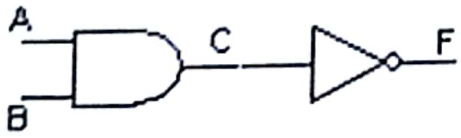
Symbol:


IC Number: 7400

Truth Table 2

| Input | | Output |
|---|---|---|
| A | B | F |
| 0 | 0 | 1 |
| 0 | 1 | 1 |
| 1 | 0 | 1 |
| 1 | 1 | 0 |

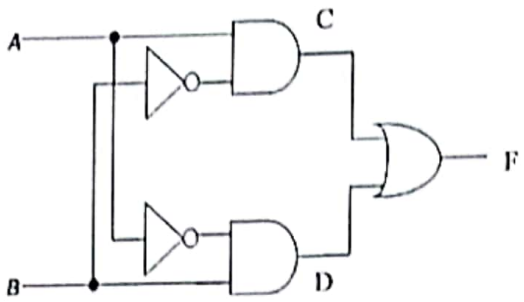
2. Complete the truth table for the following circuit.




Truth Table 3

| A | B | C | F |
|---|---|---|---|
| 0 | 0 | 0 | 1 |
| 0 | 1 | 0 | 0 |
| 1 | 0 | 0 | 0 |
| 1 | 1 | 1 | 0 |

3. Write the Boolean expression for output C, D and F the following circuit.




$C = A\overline{B}$

$D = \overline{A}B$

$F = C + D$

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

4. Complete the truth table for the circuit in (3) based on the Boolean expression produced for C, D and F.

Truth Table 4

| A | B | C | D | F |
|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 |
| 0 | 1 | 0 | 1 | 1 |
| 1 | 0 | 1 | 0 | 1 |
| 1 | 1 | 0 | 0 | 0 |

## E. Laboratory Work

### Part 1

1. Construct Circuit 1 on the breadboard. Connect all inputs (A, B) to a switches and output F to LEDs.


Circuit 1

Truth Table 5

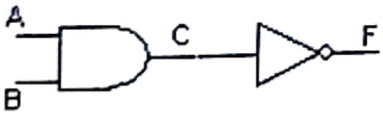
| Input | | Output |
|---|---|---|
| A | B | F |
| 0 | 0 | 0 |
| 0 | 1 | 0 |
| 1 | 0 | 0 |
| 1 | 1 | 1 |

2. Test Circuit 1 and fill in Truth Table 5 for the circuit response to all possible input combinations. The Truth Table 5 should match the Truth Table 1 prepared in the Preliminary Work.

*Fully Completed* ☐ *Partially Completed* ☐ *Checked by:* _____

### Part 2

3. Construct Circuit 2 on the breadboard. Connect all inputs (A, B) to a switches and output C and F to LEDs.




Circuit 2

Truth Table 6

| A | B | C | F |
|---|---|---|---|
| 0 | 0 | 0 | 1 |
| 0 | 1 | 0 | 1 |
| 1 | 0 | 0 | 1 |
| 1 | 1 | 1 | 0 |

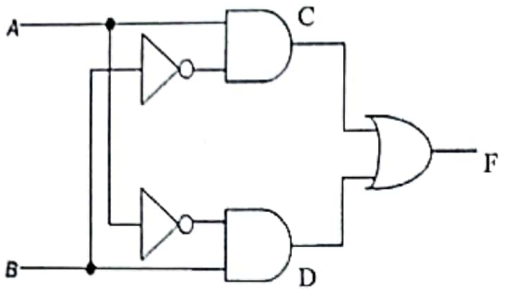
4. Test Circuit 2; fill in Truth Table 6, for the circuit response to all possible input combinations.

5. Compare Truth Table 6 to Truth Table 2. What conclusion can you make?
Circuit 2 is a NAND gate.

*Fully Completed* ☐ *Partially Completed* ☐ *Checked by:* _____

**Part 3**

6. Construct circuit 3 on the breadboard. Connect all inputs (A, B) to a switches and output C, D and F to LEDs.




Circuit 3

Truth Table 7

| A | B | C | D | F |
|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 |
| 0 | 1 | 0 | 1 | 1 |
| 1 | 0 | 1 | 0 | 1 |
| 1 | 1 | 0 | 0 | 0 |

7. Test Circuit 3; fill in Truth Table 7 for the circuit outputs (C, D, and F) for all possible input combinations.

8. What single gate does Circuit 3 represent?

XOR Gate

*Fully Completed* ☐ *Partially Completed* ☐ *Checked by:* _____