NAND & NOR GATE

OBJECTIVE:

- To investigate the behavior of the NOR gate using IC & Transistor.
- To investigate the behavior of the NAND gate using IC & Transistor.

THEORY:

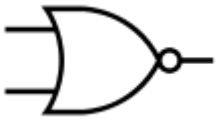
In Experiment 1, you learned the characteristics of three of the fundamental logic gates: the AND, OR, and NOT. You will now be introduced to two of the remaining logic gates: the NAND and NOR. The NAND and NOR gates are nothing more than inverted AND and OR gates, respectively. That is important, but not the most important thing. The fact that a NAND or a NOR can be used to create all other gates is important, because this fact has made them more popular in use than the others.

EQUIPMENT / REQUIREMENT:

- 7400 IC
- 7402 IC
- 4 NPN Transistor
- 4 LED or Logic probe
- 0-5 volt DC power supply

PROCEDURE:

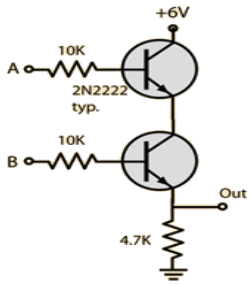
Figure 2-1 shows logic symbols of NAND & NOR *Figure 2-2* shows the layouts of NAND gate IC (7400) & NOR gate IC (7402). The pin configuration is also given in the layouts. Construct the circuit with the help of these layouts. Pin no. 7 and Pin no. 14 of each IC is Ground and VCC respectively. Apply different inputs on the given input pins and observe the out puts, and then complete the truth *tables 2-1* and *2-2* of these gates.

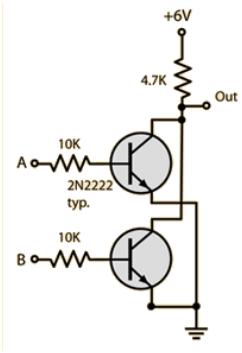


(a) NAND gate Symbol ***(b) NOR gate Symbol***

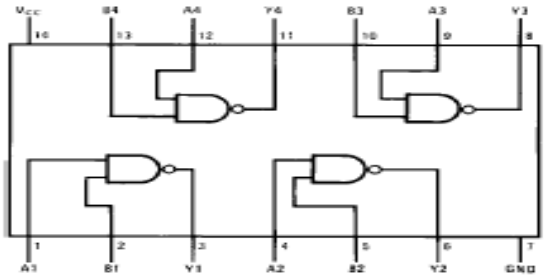
Fig2-1

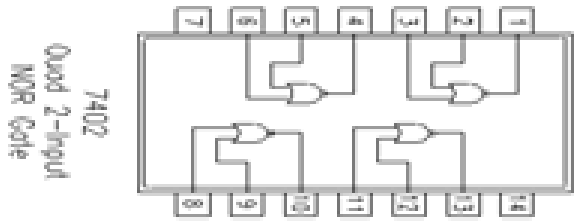
Internal Circuits of NAND, NOR Gate using Transistor





(a) NAND gate ***(b) NOR gate***





(a) IC configuration NAND 7400 gate ***(b) IC Configuration NOR 7402 gate***

Fig 2-2

<u>OBSERVATION TABLE:</u>

A	B	Q=(A+B)'
0	0	1
0	1	0
1	0	0
1	1	0

Truth Table 2-1 for NOR gate

A	B	Q=(A*B)'
0	0	1
0	1	1
1	0	1
1	1	0

Truth Table 2-2 for NAND gate

QUESTIONS / RESULTS:

1. **Why are NAND and NOR gates called universal gates?**

ANSWER:THE NAND AND NOR GATES ARE CALLED UNIVERSAL GATE BECAUSE THEY PERFORM ALL THE LOGICAL OPERATIONS OF BASIC GATES LIKE AND,OR,NOT.

2.If the 0 and 1 were inputs for a NAND gate ,what would be the output?

ANSWER:THE OUTPUT WOULD BE HIGH

3.If a signal passing through a gate is inhibited by sending a low into one of the input and the output is light ,the gate is an NAND.

4.What used with an IC , What does the term "Quaid" indicates?

ANSWER: It means the IC contains 4 blocks with same functionality.

5.A high voltage (5 volt) stood for a NAND GATE.

Addition Task to be performed:

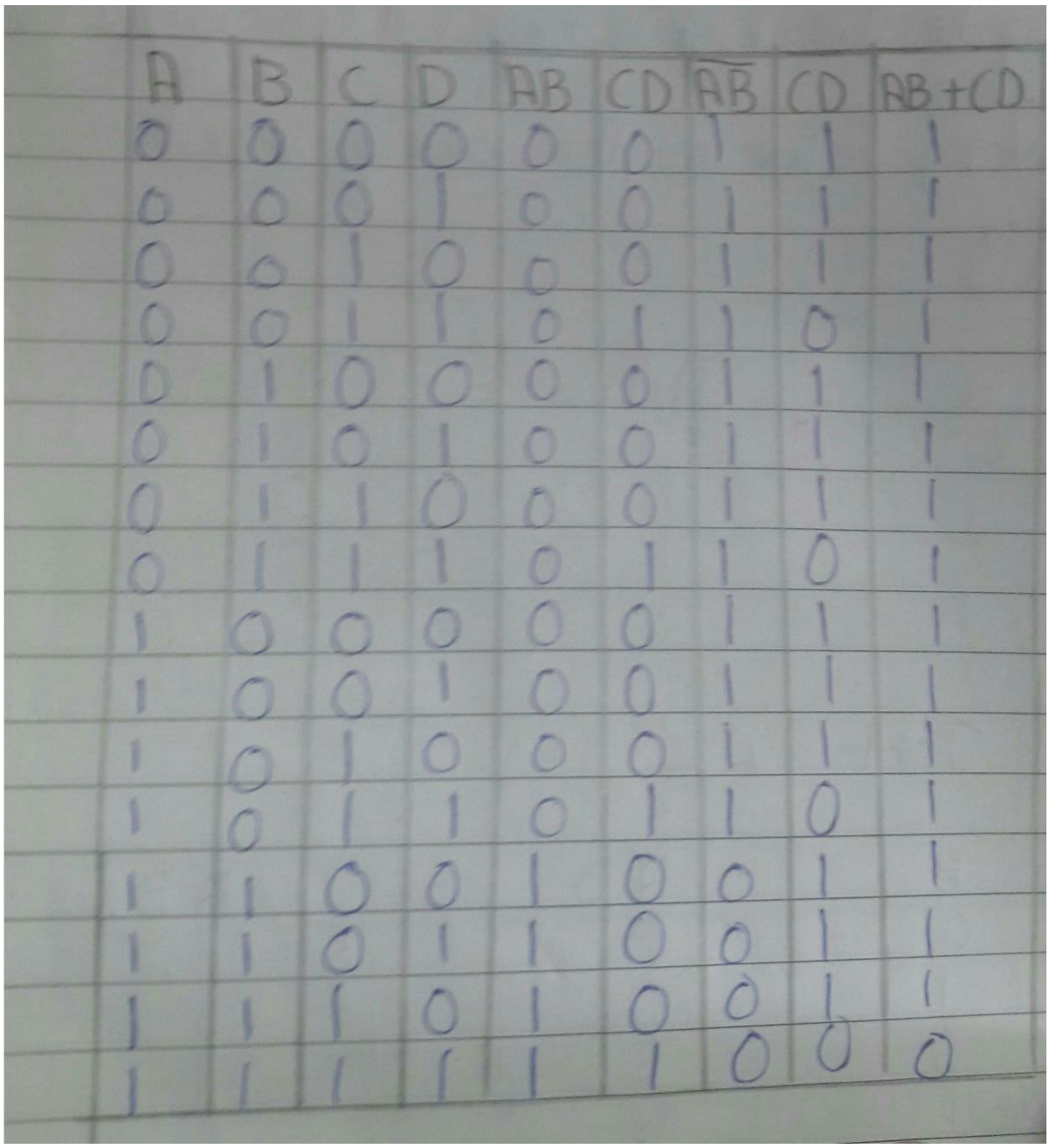
1. Implement OR gate using NAND gate
2. Implement AND, OR gate using NOR gate

CONCLUSION:

NAND: A NAND GATE PRODUCES LOW OUTPUT ONLY WHEN BOTH THE INPUTS ARE ON.

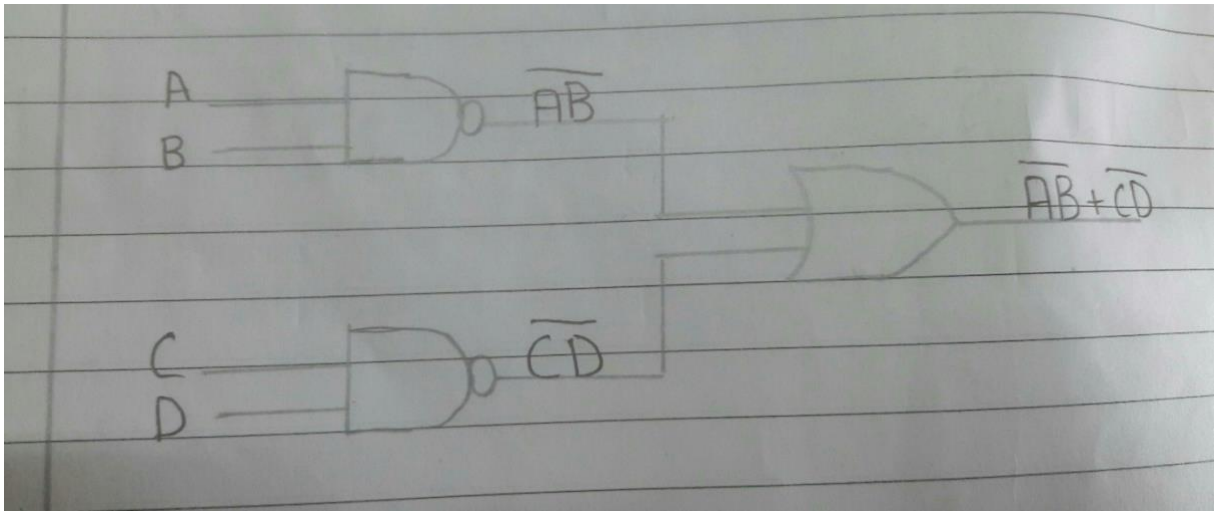
NOR: A NOR GATE PRODUCE HIGH OUTPUT ONLY WHEN BOTH THE INPUTS ARE OFF.

TASK 1:

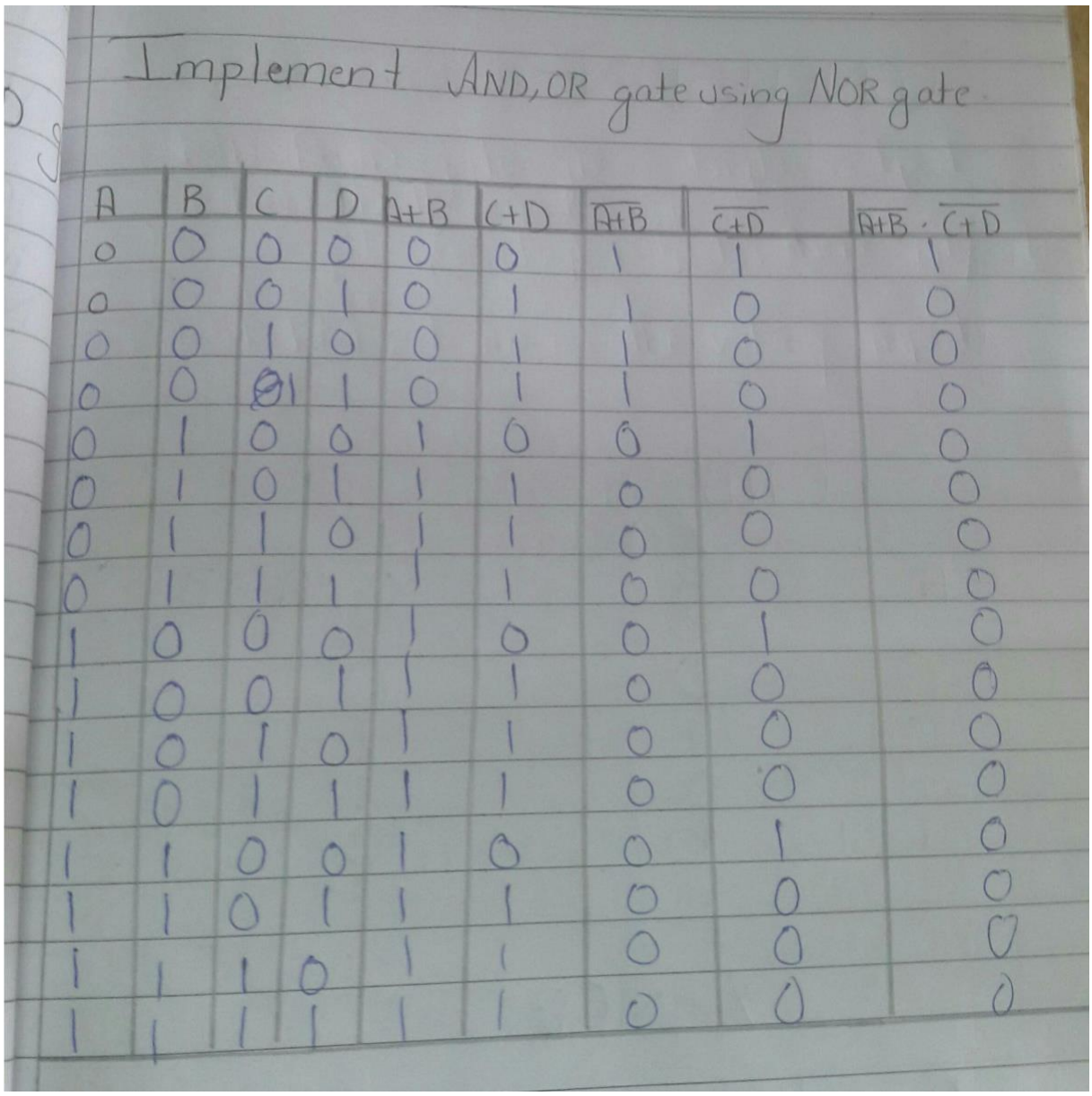


A	B	C	D	AB	CD	$\overline{AB}$	$\overline{CD}$	AB+CD
0	0	0	0	0	0	1	1	1
0	0	0	1	0	0	1	1	1
0	0	1	0	0	0	1	1	1
0	0	1	1	0	1	1	0	1
0	1	0	0	0	0	1	1	1
0	1	0	1	0	0	1	1	1
0	1	1	0	0	0	1	1	1
0	1	1	1	0	1	1	0	1
1	0	0	0	0	0	1	1	1
1	0	0	1	0	0	1	1	1
1	0	1	0	0	0	1	1	1
1	0	1	1	0	1	1	0	1
1	1	0	0	1	0	0	1	1
1	1	0	1	1	0	0	1	1
1	1	1	0	1	0	0	1	1
1	1	1	1	1	1	0	0	0

DIAGRAM:



TASK 2:



Implement AND, OR gate using NOR gate.

A	B	C	D	A+B	C+D	$\overline{A+B}$	$\overline{C+D}$	$\overline{A+B} \cdot \overline{C+D}$
0	0	0	0	0	0	1	1	1
0	0	0	1	0	1	1	0	0
0	0	1	0	0	1	1	0	0
0	0	1	1	0	1	1	0	0
0	1	0	0	1	0	0	1	0
0	1	0	1	1	1	0	0	0
0	1	1	0	1	1	0	0	0
0	1	1	1	1	1	0	0	0
1	0	0	0	1	0	0	1	0
1	0	0	1	1	1	0	0	0
1	0	1	0	1	1	0	0	0
1	0	1	1	1	1	0	0	0
1	1	0	0	1	0	0	1	0
1	1	0	1	1	1	0	0	0
1	1	1	0	1	1	0	0	0
1	1	1	1	1	1	0	0	0

DIAGRAM: