Diode AND and OR Gate Lab

Table A-1.1:

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

Table A-1.2:

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

Questions For Experiment A-1 AND Tables

1. In the prior circuits, what voltage level would a binary 1 represent? A binary 0? Are the answers the same for both circuits of Figs. A-1.5 and A-1.6?

   In the earlier circuits, a binary 1 would be shown as 4.33 V in Fig. A-1.1 and 1.89 V in Fig. A-1.3. A binary 0 would be 0 V in Fig. A-1.1 and 545 mV in Fig. A-1.3. The results for Fig. A-1.5 and Fig. A-1.6 are the same.

2. What is an OR Gate? For what percentage of the time is it on?

   An OR gate is a type of logic gate that accepts two or more inputs and produces a single output. If at least one of the inputs is high (1), the output will be high. If all the inputs are low (0), the output will be low. A three-input OR gate is on 87.5% of the time.

3. What is an AND Gate? For what percentage of time is the 3-input circuit off on?

   An AND gate is a type of logic gate that accepts two or more inputs and produces one output. If one input is high (1) and the other is low (0), the output will be low (0). If both inputs are high (1), the output will also be high (1). If both inputs are low (0), the output will be low (0). A three-input AND gate is off 87.5% of the time.

4. What function do the diodes perform in the OR and AND gates?

In the OR gate circuit, the diodes prevent the current from flowing back toward the input when the circuit is connected. This ensures the current only flows in one direction. In the AND gate, the diodes allow current to flow toward the switches and then to the ground. When the switches are off, the diodes block the current from passing through.

5. What are the fundamental differences between the two circuits shown in Fig. A-1.5 and Fig. A-1.6? Do the differences significantly affect overall outcomes? Explain?

A key difference between Fig. A-15 and Fig. A-16 is that Fig. A-15 shows an OR gate, while Fig. A-16 shows an AND gate. This difference impacts the results, as the type of circuit you build will determine whether you get a high output most of the time or a low output most of the time.

A key difference between Fig. A-1.5 and Fig. A-1.6 is that in Fig. A-1.5, the inputs are connected to power, while in Fig. A-1.6, the inputs are connected to ground. This affects the outcome because in Fig. A-1.5, the power flows through the diodes to the output and then through the resistor to ground, which lights up the LED. If the inputs are connected to ground, no current will flow through the circuit. In Fig. A-1.6, when the inputs are connected to power, the diodes block current from flowing to ground, which keeps the LED constantly on.

Another important difference is that in Fig. A-15, the resistor is connected to ground, while in Fig. A-16, the resistor is connected to +5V. This change has a big impact on Fig. A-15. If the resistor is connected to power, the LED will stay on all the time, rather than turning off when all three inputs are low (0). In Fig. A-16, if the resistor is connected to ground, no power will flow through the circuit, and the system will remain off permanently.

The final key difference is that in Fig. A-15, the diodes are oriented forward, while in Fig. A-16, the diodes are facing backwards. These changes are important because if the diodes in Fig. A-15 are flipped, the circuit won't work since current won't be able to flow. In Fig. A-16, if the diodes are flipped, the LED will remain on all the time.

Experiment No: 2
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Explain the purpose of this experiment: To build an AND and OR gate with diodes, without using ICs.

List First Learning Objective: Build a Diode OR Gate

How it is demonstrated: This objective was confirmed because the circuit I built worked as expected, showing a high (1) output when an input was high (1). It was also validated by the use of diodes in the circuit design.

List Second Learning Objective: Build a Diode AND Gate

How it is demonstrated: This objective was confirmed because the circuit I built functioned as expected, showing a high (1) output when all three inputs were high (1) and a low (0) output when the inputs were low (0).

List Third Learning Objective: Construct a truth table for a gate circuit

How it is demonstrated: This objective was validated as the truth table I created for the 3-input AND and OR gates, positively corresponded with truth tables I found online.

Conclusion: In conclusion this experiment was successful on all levels, with every learning objective having been completed flawlessly.