**Title: Introduction to Primary and Universal Logic Gates**

**Objectives**  
The objectives of this experiment are:

* To verify the input and output relationships/characteristics of 2-input AND, OR, and 1-input NOT gates.
* To gain familiarity with integrated circuits (ICs) and their pin configurations.
* To understand the practical implementation of basic logic gates using a breadboard and laboratory equipment.

**Introduction**  
Logic gates are the fundamental components of digital circuits, performing basic logical operations on binary inputs to produce binary outputs. The AND gate outputs a logic 1 only when all inputs are 1, the OR gate outputs a logic 1 when at least one input is 1, and the NOT gate inverts its input. This experiment aims to verify the truth tables of these gates using specific ICs: 7408 for AND, 7432 for OR, and 7404 for NOT. The setup involves the AT-700 Portable Analog/Digital Laboratory, a breadboard, data switches for inputs, and an LED light to observe outputs. By testing all possible input combinations, this experiment confirms the theoretical behavior of these gates and provides hands-on experience with digital electronics hardware.

**Procedures**  
The experiment was conducted following these steps from the lab manual:

1. **Identify Pin Configurations**: Determined the correct input and output pin numbers for the 7408 (AND), 7432 (OR), and 7404 (NOT) ICs using their datasheets.
2. **Setup Circuit on Breadboard**: Installed the components as shown in the circuit diagram (Fig. 1-1) on the AT-700 breadboard. Connected pin 14 of each IC to +5V and pin 7 to GND on the AT-700 power supply.
3. **Connect Inputs and Outputs**: Connected data switches "0" and "1" to points A and B of the circuit, respectively. Connected the LED light’s pins "0", "1", and "2" to the output points Y1 (AND), Y2 (OR), and Y3 (NOT) of the circuit.
4. **Test Input Combinations**: Changed the data switches "0" and "1" between logic 0 and 1 positions to apply all possible input combinations (00, 01, 10, 11) for the AND and OR gates, and 0 and 1 for the NOT gate. Observed the LED light, where a lit LED indicated logic 1 and a dark LED indicated logic 0.
5. **Record Results**: Recorded the observed outputs in a truth table for each gate.

**Experiment Pictures**

**OR GATE (7432):**

**A screenshot of a computer

AI-generated content may be incorrect.**

**AND GATE (7408):**

A screenshot of a computer

AI-generated content may be incorrect.  
**NOT GATE (7404):**

**A screenshot of a computer

AI-generated content may be incorrect.**

**Tinkercad Link**

**OR GATE:** <https://www.tinkercad.com/things/kW4hIDgljEi-213-15-4351-or-gate?sharecode=4cH3ZgP_uRT-ep_GVSZ4ZCIBar3P4qM7-PsBcmABJ6c>

**AND GATE:** <https://www.tinkercad.com/things/dPq4cLuK09q-213-15-4351-and-gate?sharecode=k8gFQDStaCl_XKx2WY0wrmOD0WsVWCs93Lt_Z_Ni3e4>

**NOT GATE:** <https://www.tinkercad.com/things/d4SpR1BU6t7-213-15-4351-not-gate?sharecode=xa7dJ-d_AeizJ4OPsGFIJOX3YRULVlEZrGHNJ49vVdM>

**Experimental Results**  
The experiment tested all possible input combinations for the AND, OR, and NOT gates, with outputs observed on the LED light. The results are summarized in the following tables:

**AND Gate (7408)**

|  |  |  |
| --- | --- | --- |
| **A** | **B** | **Y1 (AND)** |
| 0 | 0 | 0 |
| 0 | 1 | 0 |
| 1 | 0 | 0 |
| 1 | 1 | 1 |

**OR Gate (7432)**

|  |  |  |
| --- | --- | --- |
| **A** | **B** | **Y2 (OR)** |
| 0 | 0 | 0 |
| 0 | 1 | 1 |
| 1 | 0 | 1 |
| 1 | 1 | 1 |

**NOT Gate (7404)**

|  |  |
| --- | --- |
| **A** | **Y3 (NOT)** |
| 0 | 1 |
| 1 | 0 |

The LED light showed a lit LED for logic 1 and a dark LED for logic 0, matching the expected outputs for each gate based on their theoretical behavior.

**Conclusion**  
This experiment successfully verified the input-output relationships of the 2-input AND, OR, and 1-input NOT gates using the 7408, 7432, and 7404 ICs, respectively. The observed results in the truth tables matched the expected behavior: the AND gate outputs 1 only when both inputs are 1, the OR gate outputs 1 when at least one input is 1, and the NOT gate inverts its input. The practical setup on the AT-700 breadboard provided valuable experience in working with IC pin configurations, breadboard wiring, and digital circuit testing. This experiment established a solid foundation for understanding and implementing basic logic gates in digital electronics.