Module Name: Creation and analysis of logic gates matrix

1. Learning Outcomes

Upon completion of this module the learner will be able to: -

- Remember the definition of various logic gates.
- Understand the phenomenon binary operations.
- Apply to any combination of logic gates.
- Analyze binary table of any combination of logic gates.
- Evaluate the various functions of logic gates.
- Create animation/visual effects for any combination of logic gates matrix.

2. Introduction

Digital circuits are built on logic gates। They are electronic devices that can do logical operations on one or more binary inputs and then generate a binary output using logical rules that have been predefined। Here are some fundamentals of common logic gates:

- AND Gate: The AND gate has two or more inputs and produces an output of 1 (logic high) only if all of its inputs are 1; otherwise, it produces an output of 0 (logic low).

Binary Table:

Input 1	Input 2	Output 1
0	0	0
0	1	0
1	0	0
1	1	1

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- OR Gate: The OR gate also has two or more inputs and produces an output of 1 if any of its inputs is 1; it produces an output of 0 only if all inputs are 0.

Binary Table:

Input 1	Input 2	Output 1
0	0	0
0	1	1
1	0	1
1	1	1

- NOT Gate (Inverter): The NOT gate has a single input and produces the opposite (complement) of its input. If the input is 1, the output is 0, and vice versa.

Binary Table:

Input 1	Output 1
0	1
1	0

- NAND Gate (NOT-AND): The NAND gate is a combination of the AND gate followed by a NOT gate. It produces the complement of the AND gate output.

Binary Table:

Input 1	Input 2	Output 1
0	0	1
0	1	1
1	0	1
1	1	0

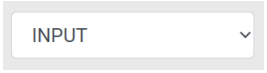
- NOR Gate (NOT-OR): The NOR gate is a combination of the OR gate followed by a NOT gate. It produces the complement of the OR gate output.

Binary Table:

Input 1	Input 2	Output 1
0	0	1
0	1	0
1	0	0
1	1	0

These are some of the basic logic gates commonly used in digital circuits. They can be combined in various ways to perform complex logical operations and implement more advanced circuits.

Step I: Different buttons available with the interface.

- 

Dropdown: to percolate inputs, gates, outputs, etc in the workspace.
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Add node: provides to add entities in the workspace.
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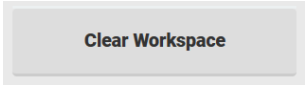
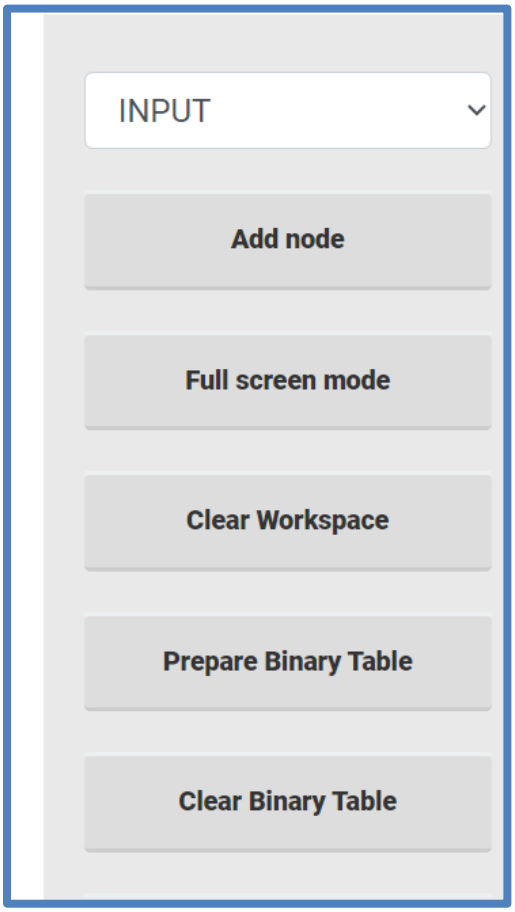
Full screen mode: to cover full screen by workspace.
- 

Clear workspace: to erase all the circuits from the workspace.

- Prepare Binary Table Prepare binary table: will provide a binary table for circuits made on the workspace.
- Clear Binary Table Clear binary table: to erase the prepared binary table from the workspace.

Output of interface

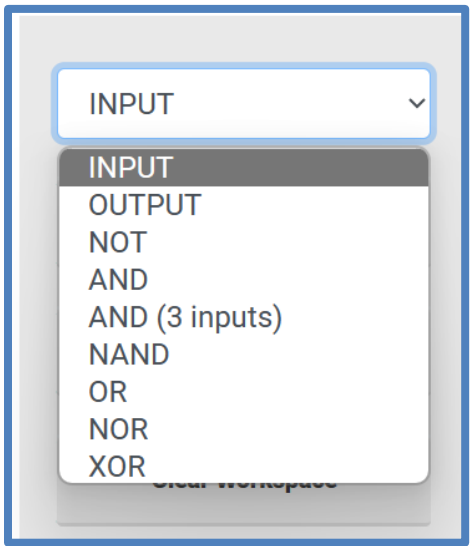


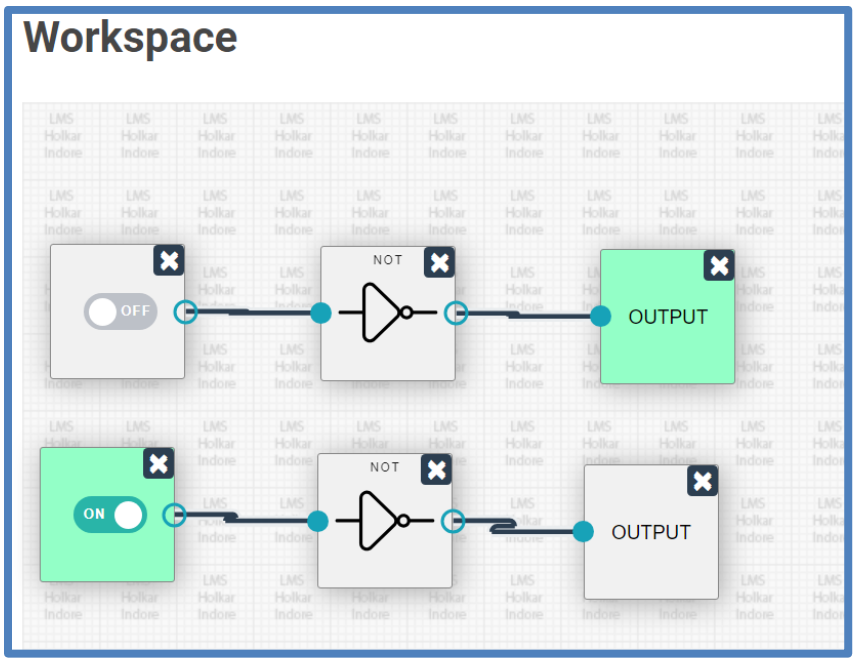
Step II: Select the Inputs, Gates and Output and prepare the circuit.

Any of the option available in the dropdown menu can be selected (Multiple times also). After selecting, click on the 'add node' button. Arrange the inputs logic gates and outputs as per the circuit diagram user wants to prepare. Follow the various operations as mentioned in step I.

- Input has two bits: ON and OFF. ON can be taken as '1' and OFF can be taken as '0'. ON and OFF also color coded. ON is reflect green; OFF is reflated with gray colors.
- Output has two color codes. Green color coded can be taken as '1' and gray color coded can be taken as '0'.
- Every button has X to delete it.

Output of interface





Prepare Binary Table

INPUT 1	INPUT 2	OUTPUT 1	OUTPUT 2
0	1	1	0

Results: Any individual or combinations of gates can be verified successfully.