Rajshahi University of Engineering & Technology

Course No: CSE 2204

Course Title: Sessional based on CSE 2203

Submitted To:

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Experiment No.: 4.1

4.1.1: Name of the experiment:

Implement Various Logic Functions (For Example

F (a, b, c, d) = SOP (0, 2, 3, 4, 6, 10, 14, 15)).

4.1.2: Objectives:

- To understand how to use the logisim software, test logic design and debug it.
- To study & implement various logic functions
- Simplifying logic circuit functions
- Understand how to implement simple circuits based on a schematic diagram using logic gates.

4.1.3: Theory:

A Boolean function is an algebraic form of Boolean expression. A Boolean function of n-variables is represented by f(x1, x2, x3….xn). By using Boolean laws and theorems, we can simplify the Boolean functions of digital circuits. A brief note of different ways of representing a Boolean function is shown below.

- Sum-of-Products (SOP) Form
- Product-of-sums (POS) form
- Canonical forms

The sum-of-products (SOP) form is a method (or form) of simplifying the Boolean expressions of logic gates. In this SOP form of Boolean function representation, the variables are operated by AND (product) to

form a product term and all these product terms are ORed (summed or added) together to get the final function.

A sum-of-products form can be formed by adding (or summing) two or more product terms using a Boolean addition operation. Here the product terms are defined by using the AND operation and the sum term is defined by using OR operation.

The sum-of-products form is also called as Disjunctive Normal Form as the product terms are ORed together and Disjunction operation is logical OR. Sum-of-products form is also called as Standard SOP.

SOP form representation is most suitable to use them in FPGA (Field Programmable Gate Arrays).

4.1.4: Experimental Analysis:

(i) Truth Table:

A	B	C	D	X
0	0	0	0	1
0	0	0	1	0
0	0	1	0	1
0	0	1	1	1
0	1	0	0	1
0	1	0	1	0
0	1	1	0	1
0	1	1	1	0
1	0	0	0	0
1	0	0	1	0
1	0	1	0	1
1	0	1	1	0

1	1	0	0	0
1	1	0	1	0
1	1	1	0	1
1	1	1	1	1

(ii) Circuit Diagram:

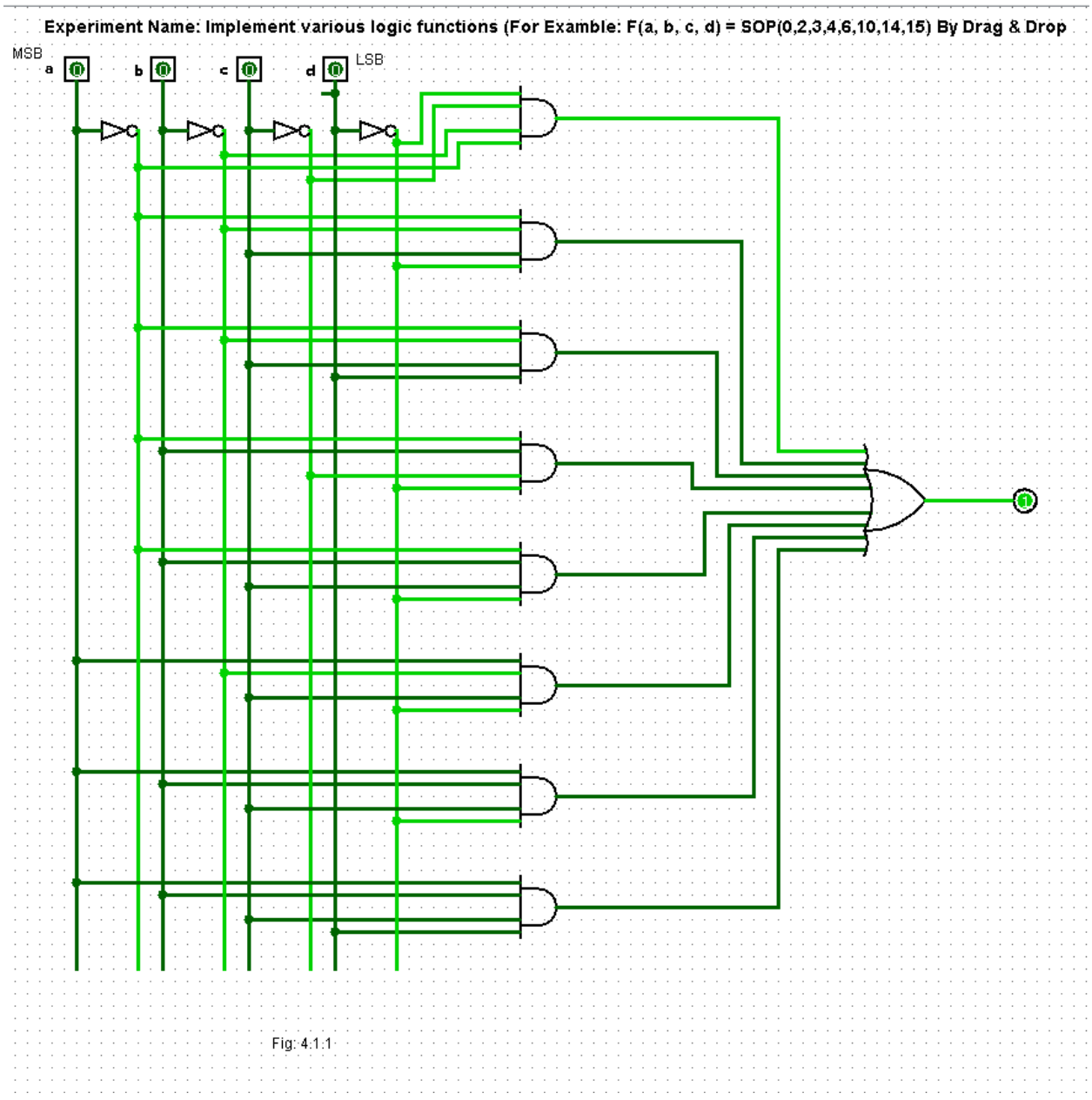

Fig: 4.1.1

4.1.5: Conclusion:

The basic logic gates are the building blocks of more complex logic circuits. A Boolean function is an algebraic form of Boolean expression. In this experiment, a Boolean function in SOP form was implemented.

Thus the experiment was implemented successfully.

Experiment No.: 4.2

4.2.1: Name of the experiment:

Verify the result of simplified version of F in 1.

4.2.2: Objectives:

- To understand how to use the logisim software, test logic design and debug it.
- To study & implement various logic functions
- Simplifying logic circuit functions
- Understand how to implement simple circuits based on a schematic diagram using logic gates.

4.2.3: Theory:

A Boolean function is an algebraic form of Boolean expression. A Boolean function of n-variables is represented by f(x1, x2, x3….xn). By using Boolean laws and theorems, we can simplify the Boolean functions of digital circuits. A brief note of different ways of representing a Boolean function is shown below.

- Sum-of-Products (SOP) Form
- Product-of-sums (POS) form
- Canonical forms

The logic function of F is simplified below:

$$\bar{a}\bar{b}\bar{c}\bar{d} + \bar{a}\bar{b}c\bar{d} + \bar{a}\bar{b}cd + \bar{a}b\bar{c}\bar{d} + \bar{a}bc\bar{d} + a\bar{b}c\bar{d} + abc\bar{d} + abcd$$

$$= \bar{a}\bar{b}\bar{d}(c+\bar{c}) + \bar{a}\bar{b}cd + \bar{a}b\bar{d}(c+\bar{c}) + ac\bar{d}(b+\bar{b}) + abcd$$

$$= \bar{a}\bar{b}\bar{d} + \bar{a}\bar{b}cd + \bar{a}b\bar{d} + ac\bar{d} + abcd$$

$$= \bar{a}\bar{b}(\bar{d}+cd) + \bar{a}b\bar{d} + ac(\bar{d}+bd)$$

$$= \bar{a}\bar{b}(\bar{d}+c) + \bar{a}b\bar{d} + ac(\bar{d}+b)$$

$$= \bar{a}\bar{b}\bar{d} + \bar{a}\bar{b}c + \bar{a}b\bar{d} + ac\bar{d} + acb$$

$$= \bar{a}\bar{b}\bar{d} + \bar{a}b\bar{d} + \bar{a}\bar{b}c + ac\bar{d} + abc$$

$$= \bar{a}\bar{d}(\bar{b}+b) + \bar{a}\bar{b}c + ac\bar{d} + abc$$

$$= \bar{a}\bar{d} + \bar{a}\bar{b}c + ac\bar{d} + abc$$

$$= \bar{a}\bar{d} + ac\bar{d} + \bar{a}\bar{b}c + abc$$

4.2.4: Experimental Analysis:

(i) Truth Table:

A	B	C	D	X
0	0	0	0	1
0	0	0	1	0
0	0	1	0	1
0	0	1	1	1
0	1	0	0	1
0	1	0	1	0
0	1	1	0	1
0	1	1	1	0
1	0	0	0	0
1	0	0	1	0
1	0	1	0	1
1	0	1	1	0
1	1	0	0	0
1	1	0	1	0
1	1	1	0	1
1	1	1	1	1

(ii) Circuit Diagram:

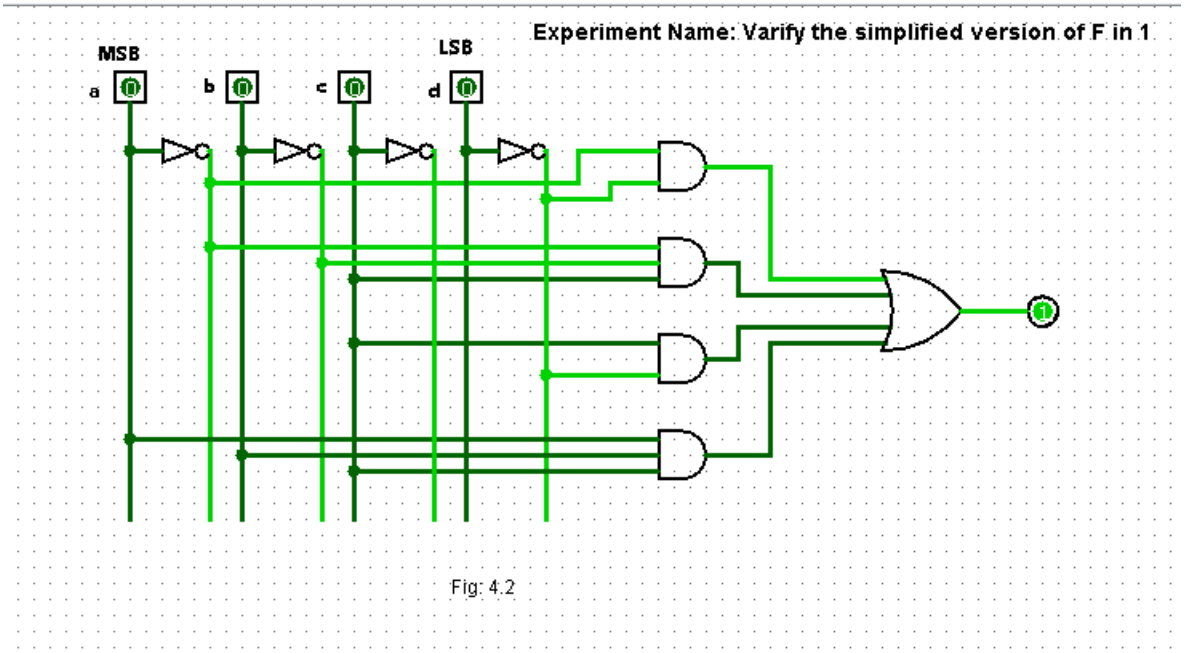

Fig: 4.2

4.2.5: Conclusion:

The basic logic gates are the building blocks of more complex logic circuits. A Boolean function is an algebraic form of Boolean expression. A simplified Boolean function is needed to build a less complex circuit. So, the Boolean function is simplified here & implemented.

Thus the experiment was implemented successfully.