Verification of Distributive Law of Boolean Algebra Using FPGA -VAMAN (PYGMY) Board

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X	Y	Z	Y+Z	X(Y+Z)	XY	XZ	XY+XZ
0	0	0	0	0	0	0	0
0	0	1	0	0	0	0	0
0	1	0	0	0	0	0	0
0	1	1	0	0	0	0	0
1	0	0	0	0	0	0	0
1	0	1	1	1	0	1	1
1	1	0	1	1	1	0	1
1	1	1	1	1	1	1	1

Table 1: Truth Table for Distributive Law

4 Considerations

As per given data, the following table has been prepared.

Symbol	Pins-pcf	Pins-Vaman	Description
X, Y, Z	Pins 27,28,31	Pins 28,27,25	Input
A,B	Pins 33, 23	Pins 23, 31	Output
VAMAN		1	
LEDs		2	For Output
Conn. wires		10	For Output

Table 2: Considerations

1 Problem statement

Verification of **Distributive Law** of Boolean Algebra using

FPGA -**VAMAN(PYGMY)** Board

2 Abstract

Distributive law of Boolean Algebra is expressed by the following expression.

Distributive Law: $\mathbf{X.(Y+Z) = X.Y + X.Z}$

In this program, Two LEDs are used for checking the output. The outputs of both RHS and LHS parts of above expression must be same with the random inputs.

5 Logic diagram of gates

Logic diagram of gates is shown in the figure 1.

Figure 1: Logic diagram of gates

3 Truth Table for Distributive Law

Truth Table for Distributive Law: $X.(Y+Z) = X.Y + X.Z$

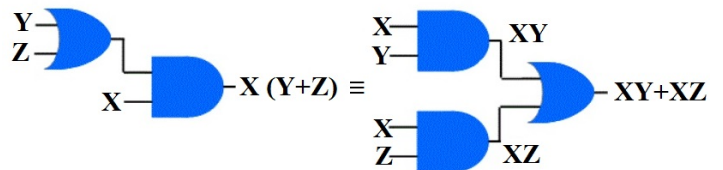
6   Solution

1. Apply the inputs X, Y, and Z (either HIGH or LOW) to the Pin no.s 28, 27 and 25 of Vaman Board(Pigmy side) as per the Truth tables.

2. Take the output from Pins 23 and 31 of Vaman Board(Pigmy side)

3. Randomly vary the inputs and note the the results.

7   SOFTWARE

1. Download the codes given in the link below and execute them.

https://github.com/meertabresali-FWC-IITH/project/blob/main/AsgnA.fpga/codes/src/helloworldfpga.v

8   CONCLUSION

1. Distributive law is expressed by

X(Y+Z)=XY+XZ with LHS = X(Y+Z), RHS = XY+XZ, and

2. Codes are written for both Distributive law and are executed using FPGA-Vaman Board.
3. Result has been displayed on LEDs (i.e. LED1, LED2).
4. LED1 is assigned for LHS of the Boolean expression of Distributive Law.
5. LED2 is assigned for RHS of the Boolean expression of Distributive Law.
6. For random digital inputs X, Y and Z as per Truth tables (at Vaman Board(Pigmy side) pins 28, 27 and 25), it has been noticed that, the output pins (23 and 31) of Vaman Board are at the same level.