

**CMPE 160 Laboratory Exercise 04**  
**Combinational Logic Circuit Design Using Boolean Algebra**  
**Simplification**

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## Abstract

The objective of this exercise is to simplify Boolean algebraic expressions to a simplified expression and implement the expressions using a combinational logic circuit. Combination logic circuits provide control signals to device or perform mathematical operations. The logic gate designed in the exercise read a a single two-bit binary number,  $N = (N1, N0)$ , and produced a single four-bit output,  $F = (W, X, Y, Z)$ , which depends on the selection control signal, "C". If  $C$  was "0" then the output value would be the square of  $N$ , ( $F = N^2$ ), and if  $C$  was "1" then the output value would be fives times  $N$ , ( $F = 5N$ ). The control signal, two-bit input and the four-bit output were recorded in a table and used to create the Boolean expressions used for the circuit. The physical cicuit performed the correct function that was theorized on the truth table.

## Design Methodology

The exercise used a two-bit binary number,  $N = (N1, N0)$  and a control signal to determine the output of the four-bit binary number shown in Table 1. The control signal determined whether the output was found using  $F = N^2$  when  $C$  was "0" and  $F = 5N$  when  $C$  was "1".

Table 1: Truth table for mathematical operations  $N^2$  and  $5N$

C	N1	N0	W	X	Y	Z
0	0	0	0	0	0	0
0	0	1	0	0	0	1
0	1	0	0	1	0	0
0	1	0	1	0	0	1
1	0	0	0	0	0	0
1	0	1	0	1	0	1
1	1	0	1	0	1	0
1	1	1	1	1	1	1

## Results and Analysis

## Conclusion