

Algebra booleana

2° Practica

Integrants:

|  |  |
| --- | --- |
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Subject: Sistemas digitales de lógica reconfigurable I

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1. **Objective:**

The objective of this practice is to learn and implement methods to derive and simplify Boolean functions from a truth table using maxterms and minterms. Through this practice, students will develop skills to derive Boolean functions and apply Boolean algebra properties to reduce them to their minimal expression, thereby enhancing their understanding and handling of fundamental concepts in digital logic.

**Methodology:**

1. Generate the truth table for each item

2. Establish the equations by minterms or maxterms according to their properties.

3. Program the obtained output functions and their input combinations.

4. Start the simulation.

5. Compare the results with the truth table.

6. Document the results.

1. **Development and Results:**

Function I

Truth table:

|  |  |  |  |
| --- | --- | --- | --- |
| A | B | C | S1 |
| 0 | 0 | 0 | 1 |
| 0 | 0 | 1 | 0 |
| 0 | 1 | 0 | 1 |
| 0 | 1 | 1 | 0 |
| 1 | 0 | 0 | 1 |
| 1 | 0 | 1 | 0 |
| 1 | 1 | 0 | 1 |
| 1 | 1 | 1 | 1 |

Simplification:

A’B’C’ + A’BC’ + AB’C’ + ABC’ + ABC

A’C’ (B’ + B) + AC’(B’+B) +ABC

A’C’ + AC’ + ABC

C’(A’+A) +ABC

C’+ABC

Function 2

Truth table:

|  |  |  |  |
| --- | --- | --- | --- |
| A | B | C | S2 |
| 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 0 |
| 0 | 1 | 0 | 0 |
| 0 | 1 | 1 | 0 |
| 1 | 0 | 0 | 0 |
| 1 | 0 | 1 | 1 |
| 1 | 1 | 0 | 0 |
| 1 | 1 | 1 | 1 |

Simplification:

AB’C+ABC

AC(B’+B)

AC

Function 3

|  |  |  |  |
| --- | --- | --- | --- |
| A | B | C | S3 |
| 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 0 |
| 0 | 1 | 0 | 0 |
| 0 | 1 | 1 | 0 |
| 1 | 0 | 0 | 0 |
| 1 | 0 | 1 | 1 |
| 1 | 1 | 0 | 1 |
| 1 | 1 | 1 | 1 |

Simplification:

AB’C+ABC’+ABC

A(B’C+BC’BC)

A(B’C+B(C’+C))

A(B’C+B)

* 1. **Code**

Next, I will provide the code with explanations for each part that composes it:

|  |
| --- |
| library IEEE;  use IEEE.std\_logic\_1164.all;  -- Entidad donde declaramos entradas y salidas  entity P2 is  port  (  A: in std\_logic;  B: in std\_logic;  C: in std\_logic;  S1: out std\_logic;  S2: out std\_logic;  S3: out std\_logic  );  end P2;  -- Arquitectura donde se hacen las operaciones o relaciones booleanas  Architecture PArch2 of P2 is  begin  S1 <= not C or (A and B and C); -- 1er ejercicio  S2 <= A and C; -- 2do ejercicio  S3 <= ((not B and C) or B) and A; -- 3er ejercicio  end PArch2; |
|  |

* 1. **Simulation**

Gráfico, Gráfico de cajas y bigotes

Descripción generada automáticamente

1. **Conclusion**

In conclusion, this practice session effectively showcased the power of Boolean algebra in simplifying complex Boolean functions derived from truth tables using maxterms and minterms. Starting with the creation of a truth table, we identified the minterms to form an initial, often lengthy, Boolean equation. By leveraging the properties of Boolean algebra, we were able to significantly reduce this equation, minimizing the number of logic gates (OR, AND, NOT) required. This simplification not only maintained the original functionality but also optimized the circuit design.