Digital System Design Lab

Lab 6

Realization of a Boolean Function

Student ID: D1166506

Name: 周嘉禾

Date: 2023/10/25

1. **Objectives**
   * To learn how to generate waveform in Quartus II
2. **Theorem**

The Boolean algebra is a fundamental concept in digital logic and computer science, used for the manipulation and analysis of binary variables. In Boolean algebra, Boolean expressions can be represented using two standard forms: minterms and maxterms.

* 1. **Minterm**

Minterms are the logical product (AND operation) of the input variables, where each term represents a specific combination of the variables that make the Boolean expression true. They are also known as the product terms and are characterized by their full disjunctive normal form.

* 1. **Maxterm**

Maxterms are the logical sum (OR operation) of the input variables, where each term represents a specific combination of the variables that make the Boolean expression false. Maxterms are the dual of minterms and are characterized by their full conjunctive normal form.

1. **Experimental Results**
   1. **Step 1**

**一張含有 圖表, 行, 螢幕擷取畫面, 繪圖 的圖片

自動產生的描述**

**一張含有 文字, 行, 螢幕擷取畫面, 數字 的圖片

自動產生的描述**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **A** | **B** | **C** | **D** | **F(A, B, C, D)** |
| 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 1 | 1 |
| 0 | 0 | 1 | 0 | 1 |
| 0 | 0 | 1 | 1 | 1 |
| 0 | 1 | 0 | 0 | 0 |
| 0 | 1 | 0 | 1 | 1 |
| 0 | 1 | 1 | 0 | 0 |
| 0 | 1 | 1 | 1 | 1 |
| 1 | 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 1 | 1 |
| 1 | 0 | 1 | 0 | 1 |
| 1 | 0 | 1 | 1 | 1 |
| 1 | 1 | 0 | 0 | 0 |
| 1 | 1 | 0 | 1 | 1 |
| 1 | 1 | 1 | 0 | 0 |
| 1 | 1 | 1 | 1 | 1 |

* + 1. *Minterm:*

F=A’B’C’D+ A’B’CD’+ A’B’CD+ A’BC’D+ A’BCD+ AB’C’D+

AB’CD’+ AB’CD+ ABC’D+ ABCD

=B’C’D+B’CD’+B’CD+BC’D+BCD

=B’C+D(B’C’+B’C+BC+BC’)

=B’C+D

* + 1. *Maxterm:*

F=(A+B+C+D)•(A+B’+C+D)•(A+B’+C’+D)•(A’+B+C+D)•

(A’+B’+C+D)•(A’+B’+C’+D)

=(B+C+D+BC+BD+CD)•(B’+C+D+B’C+B’D+CD)•

(B’+C’+D+B’C’+B’D+C’D)

=(C+D)(B’+C’+D)

=B’C+B’D+CC’+C’D+CD+DD

=B’C+D

* + 1. *Simplify*

F =A’D+BD+B’C+AB’D

=D(AB’+A’)+BD+B’C

=D(A’+B’)+BD+B’C

=B’D+A’D+BD+B’C

=D(B+B’)+A’D+B’C

=D(1+A’)+B’C

=D+B’C

* 1. **Step 2**

**一張含有 文字, 圖表, 行, 繪圖 的圖片

自動產生的描述**

一張含有 文字, 行, 數字, 圖表 的圖片

自動產生的描述

1. **Comments**

None

1. **Problems & Solutions**

When I tried to use input, I made a mistake—bind each input to a gnd. Because of it, it made my program ruined and can’t be compiled. At the end, I removed the gnds and reconnected wires, and it works!

1. **Feedback**

None