Digital System Design Lab

Lab 7
Logic Minimization Using Truth Table

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1. Objectives

- To learn how to minimize the cost with truth table
- To learn how to generate waveform in Quartus II

2. Theorem

(1) Sum of Products (SOP):

Sum of Products is a method of representing and designing digital logic circuits using Boolean algebra. In this approach, a logical expression is expressed as a sum of several product terms, where each product term consists of ANDed inputs. These product terms are then ORed together to form the final logic expression. Sum of Products is a standard way to describe the behavior of logic functions and is commonly used to design combinational circuits. It is often used when the output of a circuit should be active high for specific input conditions.

(2) Product of Sums (POS):

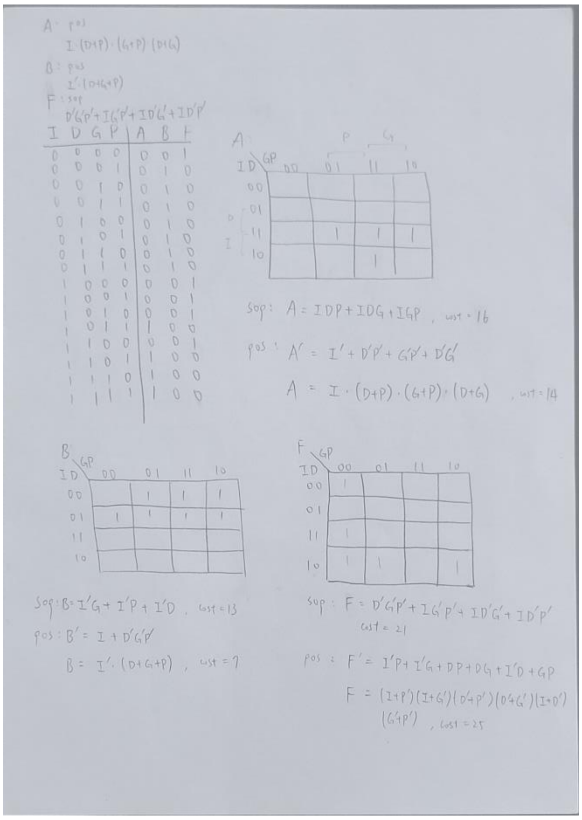
Product of Sums is another method to represent and design digital logic circuits using Boolean algebra. In this approach, a logical expression is expressed as a product of several sum terms, where each sum term consists of ORed inputs. These sum terms are then ANDed together to form the final logic expression. Product of Sums is an alternative way to describe the behavior of logic functions and is used when the output of a circuit should be active low for specific input conditions.

(3) Karnaugh Map (K-map):

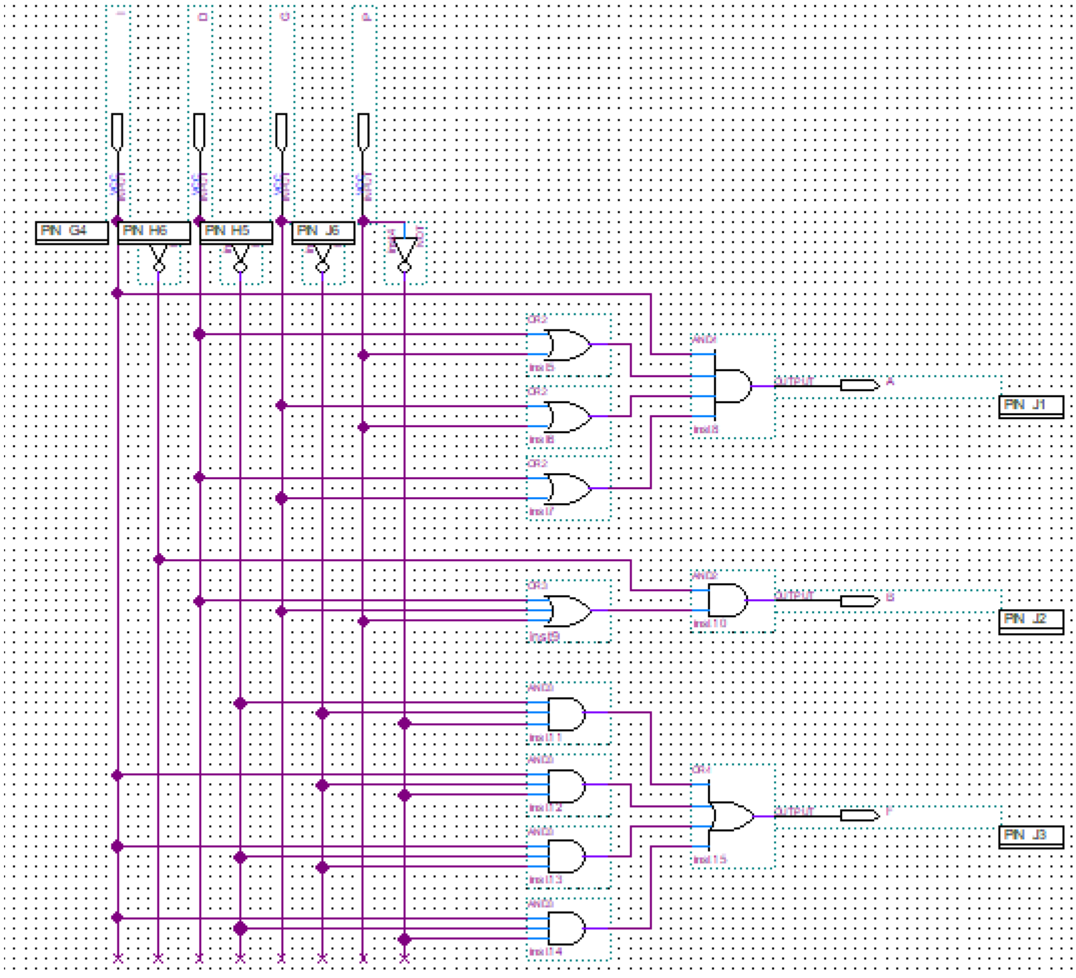
A Karnaugh Map, often abbreviated as K-map, is a graphical representation and simplification tool used to design and optimize digital logic circuits. K-maps are particularly useful for simplifying Boolean expressions and reducing the complexity of logic functions. They are especially effective for minimizing the number of gates and inputs required to implement a circuit. K-maps are essentially a grid in which cells represent all possible input combinations, and you can fill in the corresponding output values. By identifying groups of 1s (minterms) in the K-map, you can find a simplified representation of the logic function, which can be translated into a circuit design.

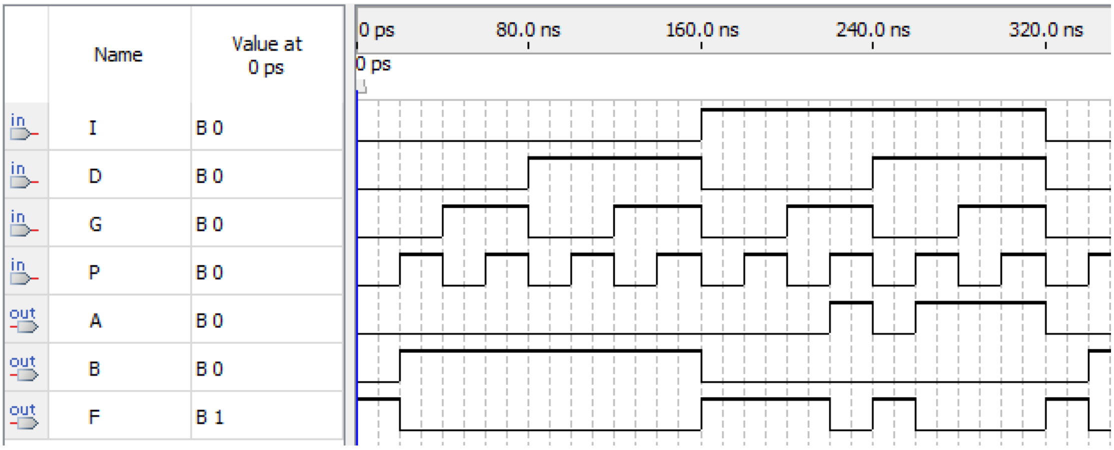
3. Experimental Results

(1) Step 1



(2) Step 2





4. Comments

In this lab, I've learned how to count the cost of a circuit and use truth table to minimize the cost of circuits.

5. Problems & Solutions

None

6. Feedback

None