Name(s)	Project Number
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Project Title

Secrets of a Digital Display: Boolean Logic in a Seven Segment Display

Abstract

Objectives/Goals

Computers, even simple ones in digital clocks and calculators, use binary arithmetic and need to convert binary, which most people can not read, to decimal. The purpose of my project was to use Boolean algebra, including truth tables, Karnaugh Maps and logic diagrams to create the logic to run a seven segment display that converts binary to decimal for the numbers 0-9.

Methods/Materials

For my experimental method, I:

1. Labeled each segment of the display a-g.
2. Drew what each digit (0-9) looks like on the display
3. Made a Boolean algebra truth table for each segment
4. Used a Karnaugh map to simplify each truth table to its Boolean equation
5. Using the Boolean equation, made a logic diagram for each segment
6. Following each logic diagram, breadboarded each segment using TTL logic and a 7-segment display.
7. Tested the outputs and troubleshooted, if necessary (it was necessary!)

My materials included a digital breadboard and lots of jumper wires, a very large LED seven segment display, 7400 Series TTL integrated circuits for the AND, OR, and NOT gates, switches and LED's for each of my 4 binary input variables, and a master switch, batteries and a 5V voltage regulator to power the circuit.

Results

I successfully used Boolean algebra equations to design the logic to convert binary into decimal using a seven segment display!

Conclusions/Discussion

The Karnaugh maps really helped me simplify the equations and the number of gates needed for each segment of the display. I also found that, by not putting an extra segment on the numbers 7 and 9, it simplified the number of gates you needed. Finally, since some segments shared common logic, you did not need to repeat gates.

Summary Statement

I used Boolean algebra to convert binary to decimal numbers shown on a seven segment display.

Help Received

My science teacher gave me suggestions; my dad taught me basic knowledge of the subject and helped do some of the wiring; my mother helped with the poster board layout