Unit 2.1: AOI Combinational Logic Design

Content Area: **Science**
Course(s): **Digital Electro**
Time Period: **Semester 1**
Length: **5 weeks**
Status: **Published**

Standards

TEC.9-12.	The use of digital tools and media-rich resources enhances creativity and the construction of knowledge.
TEC.9-12.8.1.12.A.2	Produce and edit a multi-page document for a commercial or professional audience using desktop publishing and/or graphic software.
TEC.9-12.8.1.12.C.1	Develop an innovative solution to a complex local or global problem / issue in collaboration with peers and experts and present ideas for feedback in an online community.

Enduring Understandings

Understandings

Students will understand that ...

1. There is a formal design process for translating a set of design specifications into a functional combinational logic circuit.
2. The first step in designing a combinational logic circuit is to translate a set of design specifications into a truth table.
3. A truth table describes the behavior of a combinational logic design by listing all possible input combinations and the desired output for each.
4. Logic expressions can be derived from a given truth table; likewise, a truth table can be constructed from a given logic expression.
5. All logic expressions can be expressed in one of two forms: sum-of-products (SOP) or products of sum (POS).
6. Simplified logic expressions are used to create circuits with fewer gates.
7. All logic expressions, whether simplified or not, can be implemented using AND, OR, & INVERTER gates.

Essential Questions

Students will keep considering ...

1. How can binary logic decisions be depicted in multiple forms to faciliate each stage of digital circuit design?
2. When an engineer simplifies a logic expression using Boolean algebra, how does the engineer know that they have the simplest solution (and that the solution is correct)?
3. In what ways are Boolean expressions similar and in what ways are they different from conventional algebraic expressions?
4. How can everyday problems involving descrete yes or no/on or off solutions be posed in terms of logic equations?

Knowledge and Skills

Knowledge

Students will ...

1. Know the formal design process for designing combinational logic circuits.
2. Know the truth tables and logic expressions associated with AND gates, OR gates, and INVERTER gates.
3. Know rules and laws of Boolean algebra including DeMorgan's Theorems.
4. Know that a truth table can be interpreted into an algebraic expression representing the output of the circuit.
5. Know that a simplified logic expression can produce the same outputs with fewer gates.
6. Recognize sum-of-product expressions and product-of-sum expressions.

Skills

Students will ...

1. Know the formal design process for designing combinational logic circuits.
2. Know the truth tables and logic expressions associated with AND gates, OR gates, and INVERTER gates.
3. Know rules and laws of Boolean Algebra including DeMorgan's Theorems.
4. Know that a truth table can be interpreted into an algebraic expression representing the output of the circuit.
5. Know that a simplified logic expression can produce the same outputs with fewer gates.
6. Recognize sum-of-product expressions and product-of-sum expressions.

Resources

Technology Resources

- National Instruments Multiim circuit design and simulation software
- Microsoft Office Applications

Electronics Resources

- Electronics Trainers (power supply, function generator, breadboard)
- Electronics hand tools (diagonal cutters, needle-nosed pliers, wire strippers, etc.)
- Digital Multimeters
- Digital Transistor-Transistor Logic (TTL) integrated circuits
- TTL Chip Checker

Modifications

https://docs.google.com/document/d/1ODqaPP69YkcFiyG72fIT8XsUIe3K1VSG7nxuc4CpCec/edit?usp=sharing

Assessments

https://docs.google.com/document/d/1wR7bQF-8AQoRrt0g4C3hKja0yjwDjC9_BiAmONWbTcI/edit?usp=sharing