Reading Assignment: Chapter 2 in *Logic and Computer Design Fundamentals, 4th Edition* by Mano

Chapter 2 - Boolean Algebra - comparison to regular algebra

Any algebra is built upon:

1) A set of elements
2) A set of operators
3) A set of postulates

Boolean Algebra is built upon:

1) A set of elements: {0, 1}
2) A set of operators: {+, • } – Define these in class
3) A set of postulates: the Huntington Postulates are the most common

Huntington Postulates – The following 6 postulates, along with the set of elements and set of operators shown above, uniquely and completely define Boolean algebra.

1) Closure for the operations {+, • } - Discuss

2) **<u>Two identity elements</u>: - Illustrate by considering all possible values for x**

   A) **0: $0 + x = x + 0 = x$**

   B) **1: $1 \cdot x = x \cdot 1 = x$**

3) **<u>Commutative Laws</u>: - Illustrate by considering all possible values for x and y**

   A) **$x + y = y + x$**

   B) **$xy = yx$**

4) **<u>Distributive Laws</u>: - Prove by truth table**

   A) **$x \cdot (y + z) = xy + xz$**

   B) **$x + yz = (x + y) \cdot (x + z)$**

5) Existence of a Complement: - Illustrate by considering all possible values for x

Define $x' = \overline{x}$ = "the complement of x" = "NOT x"

by the following truth table:

A) x + x' = 1

B) x • x' = 0

x	x'
0	1
1	0

6) At least two non-equal elements: {0, 1} - Discuss

Common Theorems

Boolean algebra has already been completely defined. Additional theorems are also often used, not because they are required, but because they are useful. Some of the most common theorems are shown below. Note that each theorem could be formally proven using the postulates.

1) Idempotency: ("same power")

A) x + x = x – Prove this using the postulates

B) x • x = x

Example: Show related examples using this theorem.