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Boolean ALGEBRAS AND SWITCHING CIRCUITS

A Thesis

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Abstract

Boolean algebra had its origin in the ideas presented by the philosopher George Boole in his book Investigation of the Laws of Thought (1854) on treating logic with algebraic methods.

In recent years, however, it has found more interesting applications in the theory of switching circuits used in electrical engineering and computer science. The simplest mathematical model for a Boolean algebra is furnished by the algebra of sets.

Introduction

In mathematics and mathematical logic, Boolean algebra is the branch of algebra in which the values of the variables are the truth values true and false, usually denoted 1 and 0 respectively. Instead of elementary algebra where the values of the variables are numbers, and the main operations are addition and multiplication, the main operations of Boolean algebra are the conjunction and denoted as $\wedge$, the disjunction or denoted as $\vee$, and the negation not denoted as $\neg$. It is thus a formalism for describing logical relations in the same way that ordinary algebra describes numeric relations.

Boolean algebra was introduced by George

Boole in his first book *The Mathematical Analysis of Logic* (1847), and set forth more fully in his *An Investigation of the Laws of Thought* (1854).^[1] According to Huntington, the term "Boolean algebra" was first suggested by Sheffer in 1913.^[2]

Boolean algebra has been fundamental in the development of digital electronics, and is provided for in all modern programming languages. It is also used in set theory and statistics.

Circuit switching is a method of implementing a telecommunications network in which two network nodes establish a dedicated communications channel (circuit)

through the network before the nodes may communicate. The circuit guarantees the full bandwidth of the channel and remains connected for the duration of the communication session. The circuit functions as if the nodes were physically connected as with an electrical circuit.

The defining example of a circuit-switched network is the early analog telephone network. When a call is made from one telephone to another, switches within the telephone exchanges create a continuous wire circuit between the two telephones, for as long as the call lasts.