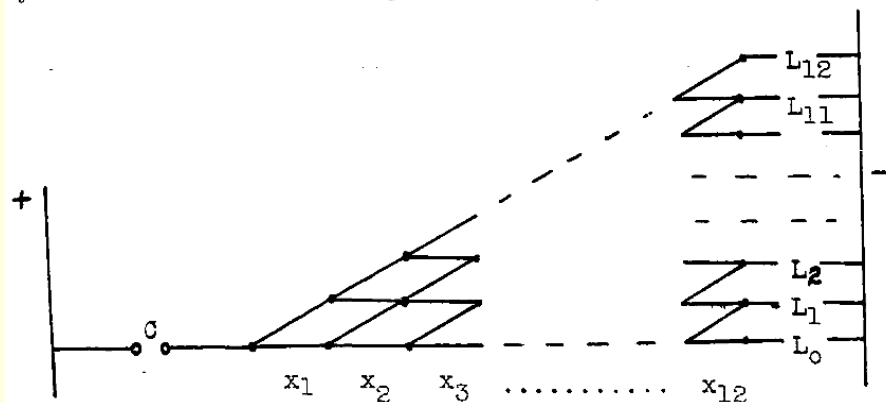


A Symbolic Analysis of Relay and Switching Circuits

Claude E. Shannon, Bell Labs (Advisor: F. L. Hitchcock, MIT)



Vote counting circuit: C is a control button and the symbols L_0, L_1, \dots, L_{12} represent lights

Problem Statement and Motivation

- In complex electrical systems it is often necessary to make intricate interconnections of relay contacts and switches
- Two problems are treated. (1) Analysis: determine the operating characteristics of a given circuit. (2) Synthesis: find a circuit incorporating certain given characteristics.

Main Result

- A calculus is developed for manipulating circuit equations that is analogous to the Calculus of Propositions used in the symbolic study of logic
- Analysis: circuit equations are interpreted in terms of the operating characteristics
- Synthesis: write desired characteristics as a system of equations, manipulate equations into simplest form, and draw circuit from equation

Conclusions and Future Work

- Our calculus can be used to design practical devices. Some illustrative examples are given:
 - (1) a selective circuit with the fewest elements
 - (2) an electric combination lock
 - (3) a vote counting circuit
 - (4) an electric adder to the base two
 - (5) a Factor Table Machine that prints a table of prime factors of integers from 1 to 100,000,000.