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Circuits of special interest

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ABSTRACT

The logic of switching circuits is a Browerian algebra B generated by two elements 1 and 0 with 2-element vectors T=(1,0), F=(0,1), D=(1,1), X=(0,0) representing the states closed, open, doubtful and Impossible assigned their meaning respectively with a contact in the circuit which allows to flow current; which does not allow to flow current; which may or may not allow to flow current or may even permit a fractional value of current through the circuit and a contact in the last state in stagnant that acts as an Insulator.

INTRODUCTION

There is a close relation between two valued logic and an electric switching circuit concept of two valued logic which are true or false which can be combined in various ways, similarly the switches of a circuits are activated by contacts which are open or closed can be combined in different ways. But in this conventional classical logic the following reverse operator [R_a 82][1]

1. (a) $c \wedge a \overset{\leftarrow}{=} b \Leftrightarrow a \wedge b = c$ and the states of c and a known, what is that state of b?

   (b) $c \vee a \overset{\leftarrow}{=} b \Leftrightarrow a \vee b = c$ and the states of c and a are known, what is the state of b?

do not determine the state. I therefore think that J.E. Whitsitt [Wh62][2] has correctly mentioned in his book that the classical logic of switching circuits is not technologically the best. My aim is therefore to develop a logic of switching circuit in which contacts are Joined with two electric lines having two voltage states 1 and 0. If these lines are called α and β then T corresponds to α=1, β=0, F to α=0, β=1 D to α=1, β=1 and X to α=0, β=0. Now if we represent, in general the logical state of a term x by the electrical states (α, β) of two lines, there four states represented by T = (1, 0), F = (0, 1), D = (1, 1), X = (0, 0) are new aspect in an electric circuit. Here the introduction of the doubtful state beautifies this system and the impossible state extends the notion of classical algebra of circuits. This paper proposes to describe and to show that the Browerian algebra is logic of switching circuit. Although G. N. Ramchandran [R_a82] has claimed in his paper that SNS (Sayad Naya System) can be beautifully implemented for modeling the switching circuits. It appears that the connectives unanimity and vidya, Considered by him had no meaning for charactering the switching circuits. So I introduced two operators → and ← which are Brower an operator which determines the physical operational values of contacts.

1. SUM AND PRODUCT CIRCUITS

Here we consider four valued switch contact which are full, zero, doubtful (or fractional) and Impossible. The circuit consisting of two switches X and Y connected in series and in parallel denoted respectively [xy] and [x+y] the contact function c of which satisfies the relations.

(a) $C(xy)= (c(Z_\alpha)), (c(Z_\beta))$

Where $(c(Z_\alpha)) = \min(c(x_\alpha), c(y_\alpha))$

And $c(Z_\beta) = \max(c(x_\beta), c(y_\beta)$

(b) $C(x+y) = (c(Z_\alpha), c(Z_\beta))$

Where $(c(Z_\alpha)) = \max(c(x_\alpha), c(y_\alpha))$

And $c(Z_\beta) = \min(c(x_\beta), c(y_\beta)$

Table 1

Truth tables for C(xy) and C(x+y)

C(xy)	T	F	D	X
T	T	F	D	X
F	F	F	F	F
D	D	F	D	F
X	X	F	F	X

C(x+y)	T	F	D	X
T	T	T	T	T
F	T	F	D	X
D	T	D	D	T_D
X	T	X	T_D	X

Here T_D stands for doubtful truth. The concept of reverse operator in the previous leads to the notion of a particular contact value of switch connected either in series or in parallel.

(c) $c(y)\Leftrightarrow c(z)$ where $c(z_\alpha)= \min(C(x_\alpha), C(y_\alpha))$
$C(z_\beta)=\max(C(x_\beta), C(y_\beta))$

and the states of c(z), c(x) are known, what is the state of c(y)?

(d) $C(y)\Leftrightarrow C(z)$ where $c(z_\alpha)= \max(C(x_\alpha), C(y_\alpha))$

$C(z_\beta)=\min(C(x_\beta), C(y_\beta))$

and the states of c(z), c(x) are known what is the state of c(y)?

It should be marked that here c(z) stands for the output value of contact function of any state for the sake of convenience we represent (1,0): (0,1): (1,1): & (0,0)

as 1,0, $\frac{1}{r}$ and x where $4 \neq 0$ in any positive integer.

A circuit is said to be full, doubtful, empty, or inacceptable respectively denoted by [1] [$\frac{1}{r}$][0] or [x] according as c(x) =1, $\frac{1}{r}$, 0 or [x]

Two circuits are said to be equal if they are both full or both doubtful or both empty or both inacceptable.

The order in the switching circuits can be defined in terms of equality of circuits by setting $[x]\geq[y]$ iff [xy] = [y]

It can be easily verified that the system of switching circuits in a distributive lattice.

2. CONTACT RELATION:

The following two Brower an Operator determines contact relations [Th77][3] If x and y be any two contact the contact function of x with respect to that of y denoted by $C(x\rightarrow y)$

and dual contact function of x with respect to that of y denoted by C(x←y) where

(3) (a) $x \rightarrow y = \bigvee_{z \wedge x \leq y} z$

(3) (b) $x \leftarrow y = \bigwedge_{z \vee x \geq y} z$

determines two circuits [x→y] and [x←y] which are regarded as the output circuits obtained after operating physically a contact X with respect to contact Y.

The distributive lattice of switching circuits can be verified since the fourth state X can have no operational meaning, we do not consider this state in forming the truth tables for C(x→y) and C (x←y)

Table 2

C(x→y)	1	$\frac{1}{r}$	0
1	1	$\frac{1}{r}$	0
$\frac{1}{r}$	1	1	0
0	1	1	1

C(x←y)	1	$\frac{1}{r}$	0
1	0	0	0
$\frac{1}{r}$	1	0	0
0	1	$\frac{1}{r}$	0

Associated with a circuit [x] we define a circuit [c(x) →0]

denoted by [⌈x] and its dual [c(x) ←1]

denoted by [⌉ x] with the properties

[x] ≤ [⌈ ⌈x]

[⌈ X] = [⌈ ⌈ ⌈x] = ……..

[⌈ ⌈X] = [⌈ ⌈ ⌈ ⌈X] = ……….

3. CIRCUITS OF SPECIAL INTEREST

This section is concerned with a few examples of circuits which have Interactive properties

4 (a) [x+ ⌈X] = [$\frac{1}{r}$] if C(x) = $\frac{1}{r}$

= [1] otherwise

4 (b) [(x ⌈x)] = [0]

4 (c) [⌈(x+y)] = [⌈x ⌈Y]

4 (d) [⌈(xy) ≥ [(⌈x)+(⌈y)]

It in clear that only one Demorgan law with respect to sum(+) & product (silent) holds good we there fore introduce the Browerian sum [Ru66][4] by setting

x ⊕ y = ⌈X+ ⌈y

Theorem 1 The Demorgan laws as Valid in (B, $\oplus$)

Proof: We have

$$\ulcorner (x \oplus y) = \ulcorner \ulcorner \ulcorner (x+y)$$
$$= \ulcorner (x+y)$$
$$= \ulcorner x + \ulcorner y$$

$$\ulcorner (xy) = \ulcorner \ulcorner (\ulcorner x + \ulcorner y)$$
$$= \ulcorner x \oplus \ulcorner y$$

Theorem 2. A set $B_o \subseteq B$

Consisting of contacts such that

$x = \ulcorner \ulcorner x$ in a Boolean algebra to sum $\oplus$ and the product.

Proof: For $x = \ulcorner \ulcorner x$ only when

$x = (0,1)$ or $(1,0)$

Theorem 3. The algebra of three states T, D, F is an intuitionist logic [B_i67][5]

Proof: For this algebra in a finite distributive lattice in which

$$\urcorner \urcorner X \leq X;$$
$$\urcorner x = \urcorner \urcorner \urcorner X = \ldots\ldots\ldots\ldots$$
$$\urcorner \urcorner X = \urcorner \urcorner \urcorner \urcorner X = \ldots\ldots\ldots..$$

Remarks1 This logic of switching circuit in a classical logic off $\ulcorner x = \urcorner x$

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