PROJECT STRETCH
FILE MEMO #9

SUBJECT: A Method of Coding Logical Functions for the
Stretch Selector System
By N. Rochester

This coding method makes it possible to represent logical functions constructed of the symbols ., v, -,), and (in decimal digits. This scheme was devised by G. M. Amdahl and final polishing of it was done on 12/8/55 in a meeting with G. M. Amdahl, E. M. Boehm, N. Rochester, and W. Hunt.

The symbols are as follows:

name	conventional symbol	decimal representation	
		if next symbol is an operation	if next symbol is a variable
logical and	..	0	1
logical or	v or +	2	3
denial	—	4	not needed
left bracket	(	5	6
right bracket	)	7	not needed
stop	blank	8	not needed

Variables will be represented by two-digit numbers and the denial mark (4), if needed, will follow the number. An example of a logical function and its translation to digits is as follows:

$$\left(\overline{(\overline{23} \text{ v } 16)} \cdot (48 \text{ v } \overline{29}) \right)$$

56 23 43 1 67 40 64 83 29 47 748

It is possible to reduce the notation further because certain transitions do not occur. Stop and denial can follow a variable or a right bracket but cannot follow "or", "and", or a left bracket. A left bracket can follow "or" or "and" but cannot follow stop, denial, or a right bracket. Therefore, the following notation is unambiguous

name	conventional symbol	if next symbol is an operation	if next symbol is a variable
logical and	•	0	1
logical or	v or +	2	3
denial	—	4	not needed
left bracket	(	4	6
right bracket	)	5	not needed
stop	blank	6	not needed

The machine rules are:

4   is denial if it follows a variable or a right bracket but it is
     a left bracket followed by an operation if it follows an "and"
     or an "or" or a left bracket.

6   is stop if it follows a variable, a denial, or a right bracket
     but it is a left bracket followed by a variable if it follows an
     "and" or an "or" or a left bracket

     A final additional compression of the coding may be made by using
an extra right bracket for stop. In order to benefit from this it is necessary
to complicate things a little more. There can actually be no ambiguity about
whether a bracket is a right or a left bracket because they arise differently.
This makes it possible to use a 5 for either left bracket followed by a vari-
able or a right bracket.

     There are thus several different schemes that allow a conventional
logical function expressed in boolean algebra to be coded for a calculator.
The same symbols may be used to express the variables and the operations.
This may easily be done using decimal digits for symbols. The number of
distinct symbols can be reduced to six and still have only one symbol in the
new code for each symbol in the original. code.

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NR/sfl