Design of many-valued logical circuits

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Abstract

In this paper we generalise the problem of design of logical circuits to the finitely-many-valued logic. We divide the problem into two parts.

The first part is the design of combinational logical circuits. It consists of expressing any logical function by a finite set of operations in a normal form. We present a tool of many-valued Svoboda maps[1] (called also Veitch or Marquand maps) which can be used to find optimized normal forms. Our approach is based on functionally complete sets of operations given by Łukasiewicz connectives extended by rational constants[2], standard connectives extended by rational constants, Kronecker delta and Łukasiewicz equivalence. Other possibilities, functionally complete sets of operations given by many-valued Sheffer operation or many-valued Pierce operation will be discussed.

The second part presents a many-valued memory circuit based on a generalisation of the R-S circuit known from the two-valued logic. This approach is based on the operation of negated standard conjunction.

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[1] See [9, 4, 8].

[2] Rational Pavelka Logic, see [11, 7].

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