

Bilattices of bi-De Morgan Functions

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It is commonly known that the free Boolean algebra on n free generators is isomorphic to the Boolean algebra of Boolean functions of n variables. The free distributive lattice on n free generators is isomorphic to the distributive lattice of monotone Boolean functions of n variables. In previous papers we have introduced the concept of De Morgan function and proved that the free De Morgan algebra on n free generators is isomorphic to the De Morgan algebra of De Morgan functions of n variables. This is a solution of the problem posed by B.I. Plotkin.

A bilattice is a set with two lattice structures (the connection between the Lattice structures is postulated, too). Bilattices are a natural generalization of the classical two-valued logic, and were introduced by M. Ginsberg. Then M. Fitting found that bilattices provided a uniform semantics for the logic programming languages. Characterizations of bilattices of different varieties by the superproduct of two lattices proved by various authors (M. Ginsberg, M. Fitting, A. Romanowska, Yu. Movsisyan, J.D.H. Smith, A. Avron, and others) is well-known.

In this paper we give a new characterization of distributive bilattices via new Boolean-type functions. Namely we introduce the concepts of bi-De Morgan function and prove that the bi-De Morgan functions of n variables form a distributive bilattice and that the free distributive bilattice on n free generators is isomorphic to the distributive bilattice of bi-De Morgan functions of n variables.