On Representations of Distributive Involutive Residuated Lattices by Binary Relations

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The collection of all binary relations on a set is a representable relation algebra, and if we replace the complementation and the converse operation with the operation of complement-converse then we obtain an interesting class of subreducts, known as representable weakening relation algebras, that are distributive involutive residuated lattices.

A binary relation defined on a poset is a weakening relation if the partial order acts as a both-sided compositional identity. We present a two-player game for the class of representable weakening relation algebras akin to that for the class of representable relation algebras. This enables us to define classes of abstract weakening relation algebras that approximate the quasivariety of representable weakening relation algebras and produce explicit finite axiomatizations for some of these classes. We define the class of diagonally representable weakening relation algebras and prove that it is a discriminator variety. We also provide representations for several small weakening relation algebras.

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