

## FOUR-PART SEMIGROUPS - SEMIGROUPS OF BOOLEAN OPERATIONS

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### Abstract

Four-part semigroups form a new class of semigroups which became important when sets of Boolean operations which are closed under the binary superposition operation  $f + g := f(g, \dots, g)$ , were studied. In this paper we describe the lattice of all subsemigroups of an arbitrary four-part semigroup, determine regular and idempotent elements, regular and idempotent subsemigroups, homomorphic images, Green's relations, and prove a representation theorem for four-part semigroups.

**Keywords:** four-part semigroup, Boolean operation.

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## REFERENCES

- [1] R. Butkote and K. Denecke, *Semigroup Properties of Boolean Operations*, Asian-Eur. J. Math. **1** (2008) 157–176.
- [2] R. Butkote, *Universal-algebraic and Semigroup-theoretical Properties of Boolean Operations* (Dissertation Universität Potsdam, 2009).

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