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Author: S. Omid B. Davvaz

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# Contribution to the study special kinds of hyperideals in ordered semihyperrings

S. Omidi and B. Davvaz

Department of Mathematics, Yazd University,  
Yazd, Iran  
omidi.saber@yahoo.com  
davvaz@yazd.ac.ir

## Abstract

In the present paper, we introduce the notion of  $k$ -hyperideals on ordered semihyperrings. Then, we investigate some fundamental properties of  $k$ -hyperideals of ordered semihyperrings. Indeed, we define  $(m, n)$ -hyperideals and  $(m, n)$ -bi-hyperideals in ordered semihyperrings and investigate some of their related properties. Moreover, we introduce and analyze the notion of prime  $(m, n)$ -bi-hyperideal of an ordered semihyperring.

**Keywords:** ordered semihyperring, hyperideal,  $k$ -hyperideal,  $(m, n)$ -hyperideal, prime  $(m, n)$ -bi-hyperideal.

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## 1 Introduction and prerequisites

The notion of quasi-ideals was introduced by Steinfeld for rings [1] and semigroups [2] as a generalization of the one-sided ideals. A short review of the theory of quasi-ideals appears in [3]. Good and Hughes [4] introduced the notion of bi-ideals of semigroups. Quasi-ideals are a particular case of bi-ideals. Lajos [5, 6] introduced and studied the notion of  $(m, n)$ -ideals of semigroups as a generalization of bi-ideals. Ansari et al. [7] worked on  $(m, n)$ -quasi-ideals of semigroups. Shabir and Kanwal [8] studied prime bi-ideals of semigroups. In [9], Sanborisoot and Changphas introduced the notion of  $(m, n)$ -ideals in ordered semigroups.

The notion of semirings introduced by Vandiver [10] in 1934, which is a generalization of rings. Semirings are very useful for solving problems in graph theory, automata theory, coding theory, analysis of computer programs, and so on. We refer to [11] for the information we need concerning semiring theory. In 1992, Sen and Adhikari [12] studied  $k$ -ideals in semirings. In [13, 14], quasi-ideals of semirings are studied and some properties and related results are given. To see more about  $(m, n)$ -quasi-ideals in semirings, we refer the reader to [15]. In 2011, Gan and Jiang [16] considered and

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