

# Simple intersection graph of a finite lattice

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## Abstract

The study of graphs associated with algebraic structures constitutes a central and rapidly evolving research direction within algebraic graph theory. This field is based on the principle of defining a graph in terms of the elements and operations of an algebraic system, thereby establishing a formal link between two distinct mathematical disciplines. Inspired by several types of graphs associated with finite lattices, a new graph called the simple intersection graph is introduced in this article. For a finite lattice  $L$ , let  $\mathcal{I}(L)$  denote the set of all nonzero ideals in  $L$ . The simple intersection graph of  $L$ , denoted by  $G_{SI}(L)$ , is a graph with  $V(G_{SI}(L)) = \mathcal{I}(L)$  and two distinct vertices  $I_j, I_k \in \mathcal{I}(L)$  are adjacent if  $I_j \cap I_k$  is a nonzero simple ideal. Several graph-theoretic parameters of  $G_{SI}(L)$ , such as girth, diameter, clique number, and independence number, are investigated. In addition, the necessary and sufficient conditions are established for  $G_{SI}(L)$  to be isomorphic to certain well-known classes of graphs.

**Keywords:** Simple ideal, Complete graph, Path graph, Star graph.

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