UCCS Department of Mathematics

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The multiplicative ideal theory of Leavitt path algebras- Are Leavitt path algebras really commutative algebras in non-commutative clothing?

ABSTRACT

Leavitt path algebras of directed graphs E over a field K are algebraic analogues of graph C^*-algebras of operators on Hilbert spaces and are also generalizations of the algebras introduced by William Leavitt as non-IBN algebras. Ever since their introduction 14 years ago, their study has become an active area of research.

In this talk, I shall report on some of the recent investigations illustrating two essential features of these algebras. Every Leavitt path algebra L is endowed with three structures: It is an associative algebra over a field K; it is a $\mathbb{Z}$-graded algebra; it is an algebra with an involution $*$. These intermingling structures come to play in the deeper study of the ideals of L. I will illustrate how a single graphical property of E often gives rise to several ring properties of L and these properties usually are independent of each other for general rings. This special feature makes the Leavitt path algebras really useful tools in constructing examples of rings various types.

The second feature of L is about its ideal lattice. In general, a Leavitt path algebra L is highly non-commutative: Almost always, $ab \neq ba$ for elements a, b in L. In spite of this, L seems to possess properties of commutative rings in terms of their ideal lattices. To start with, the ideal multiplication in a Leavitt path algebra is commutative. It turns out that the ideals of L satisfy the characterizing properties of the various types commutative integral domains such as the Bézout domains, the Dedekind domains, the Prüfer domains, the almost Dedekind domains etc. One important consequence of these results is that there is a satisfactory theory of factorizing the ideals of L as products of the prime, the primary, the irreducible or the radical ideals respectively. Various graphical constructions will illustrate these conclusions.

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