



The rising STAR of Texas

Discrete Mathematics Seminar

Time: Friday, April 8, 2022, 1:00-2:00 PM (Central Time)
Title: Generalizing Box Products and Cellular Resolutions of Powers of Monomial Ideals
Speaker: Dr. Susan Morey, Department of Mathematics, Texas State University
Room: 330 Derrick Hall

Abstract:

In linear algebra, a basis for a vector space is often used to obtain desired information. When expanding beyond vector spaces, a new approach is needed. A free resolution is one tool commonly used in commutative algebra and related fields to obtain information about an ideal. Using combinatorial structures to obtain resolutions of monomial ideals is an idea that traces back to Diana Taylor's thesis, where a simplex associated to the generators of a monomial ideal was used to construct a free resolution of the ideal. This concept has been expanded over the years, with various authors determining conditions under which simplicial or cellular complexes can be associated to monomial ideals in ways that produce a free resolution. This talk will focus on powers of square-free monomial ideals of projective dimension one. Trees and their graph products will be used to produce cellular complexes that support (minimal!) free resolutions of the powers of the ideal. A generalization of an edge-incidence matrix will appear along the way. It turns out that the cellular resolutions can also be viewed as strands of the resolution of the Rees algebra of the ideal, providing an unexpected link between a convex (cubical!) embedding of a cellular complex and a Koszul complex. The talk will include background information on the algebraic parts. This research stems from a project initiated at a BIRS workshop "Women in Commutative Algebra" in Fall 2019, and contains joint work with Susan Cooper, Sabine El Khoury, Sara Faridi, Sarah Mayes-Tang, Liana Segal, and Sandra Spiroff.