



## Online ISU Algebra Seminar

**Date and Time:** September 1, 2022 from 1:00 pm to 1:50 pm

**Speaker:** Tung T. Nguyen (University of Western Ontario)

**Title:** On the joins of circulant matrices

**Abstract:** Networks of nonlinear oscillators have attracted interest in several scientific domains such as theoretical physics, mathematical biology, power-grid systems, and many more. A natural model of a network of oscillators is a circulant graph; a graph whose adjacency matrix is circulant. By the discrete Fourier transform, we can describe the spectrum of a circulant graph explicitly; and consequently many problems involving circulant graphs have closed-form solutions. Many real-world networks, however, display structure beyond that of circulant networks. For example, networks may be composed of several smaller modules joined together. From both a theoretical and an applied perspective, it is important to develop a systematic understanding of the structure of these joined networks. This naturally leads us to investigate the join algebra, an algebra that describes precisely this join construction. In my talk, I will discuss this algebra and some of its properties. Time permitting, I will explain some applications in nonlinear dynamics. This is based on joint work with Sunil Chebolu, Jonathan Merzel, Jan Minac, Lyle Muller, Federico W. Pasini, and Nguyen Duy Tan.

**About Speaker:** Dr. Tung T. Nguyen obtained his Ph.D. in 2020 from the University of Chicago with a specialty in algebraic number theory. He can trace his fascination with mathematics to his high school days where he became involved with various mathematical circles and Mathematical Olympiads. As an undergraduate student he collaborated on a book dedicated to research. Number theory and combinatorics have always been topics which he treasured. His recent research interests include spectral graph theory, representation theory, dynamical systems, and computational neuroscience. He loves to collaborate and to share his enthusiasm for mathematics with everyone. He directed 8 undergraduate students to do independent study and research in mathematics.

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