An Introduction to Algebraic Methods for the Erdős-Ko-Rado Theorem

The first half of this talk will be a gentle introduction to the Erdős-Ko-Rado (EKR) Theorem. This is a theorem that determines the size and structure of the largest collection of intersecting sets. It has become a cornerstone of extremal set theory and has been extended to many other objects. I will show how this result can be proven using techniques from algebraic graph theory.

In the second half of this talk I will give more details about extensions of the EKR theorem to permutations. Two permutations are intersecting if they both map some $i$ to the same point (so $\sigma$ and $\pi$ are intersecting if and only if $\pi^{-1}\sigma$ has a fixed point). In 1977, Deza and Frankl proved that the size of a set of intersecting permutations is at most $(n-1)!$. It wasn’t until 2003 that the structure of sets of intersecting permutations that meet this bound was determined. Since then, this area has developed greatly and I will give details about the recent results in this area. Again, my focus will be on algebraic techniques, and I will show how the characters of the group can be used to prove the result.

Speaker Biography:

Karen Meagher is a professor at the Mathematics and Statistics Department at the University of Regina. Most of her research is focused on the Erdős-Ko-Rado theorem. This involves generalizations and extensions of this theorem using a variety of methods. I am also interested in design theory, including constructions and bounds of covering arrays. She works on extremal set theory and is interested in extensions of results in extremal set theory to partitions and permutations. She has worked on applying methods from algebraic graph theory to design theory problems. I have also done work on covering arrays, zero-forcing sets for graphs, inverse eigenvalue-type problems and metric dimension of graphs.

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