The Algebra Seminar

In a normal semester, the seminar would meet on Tuesdays in room WH-100E at 2:50 p.m. There would be refreshments served at 4:00 in room WH-102. But under the current COVID-19 pandemic, in-person seminar talks do not seem safe, and no refreshments or socializing in person will be allowed in Fall 2020 and Spring 2021.

We therefore propose that all speakers at the Algebra Seminar present their talks using Zoom. Anyone wishing to give a talk in the Algebra Seminar this semester is requested to contact the organizers at least one week ahead of time, to provide a title and abstract. The Zoom meeting link is below.

Organizers: Alex Feingold and Hung Tong-Viet

To receive announcements of seminar talks by email, please join the seminar's mailing list.

You may wish to download and import the following iCalendar (.ics) files to your calendar system. Weekly: https://binghamton.zoom.us/meeting/tJEtdOmuqzwpEtGNr3pf7HnHS0ysG2xzxC99/ics?icsToken=98tyKuCtrjgqHNGSsxGCRowMAojCc-7wmGZej7d6sg22EyYESg3eBbJbIZUtCMLI

You may also use the following link to join each Algebra Seminar Zoom Meeting: https://binghamton.zoom.us/j/95030657385

Please note that we have now implemented a Passcode required to join the zoom meeting. That passcode is the number obtained by adding up all the positive integers from 1 to 100, 1+2+...+100. That should keep the zoom bombers out!

Spring 2021

- **February 16**
  Organizational Meeting

  Join Zoom Meeting using this link. The Meeting ID: 950 3065 7385. Please think about giving a talk in the Algebra Seminar, or inviting an outside speaker.

- **February 23 at 4:15 PM in the Arithmetic Seminar**
  Fikreab Admasu (Binghamton University)
  Bhargava's composition law for binary cubic forms

Abstract: The Delone-Fadeev correspondence shows that binary cubic forms with integer coefficients parametrize orders in cubic fields. With this result in mind, Bhargava constructs a binary cubic form 2x3x3 boxes of integers and proves that there is a natural composition law for the boxes of integers. The group resulting from this law is then shown to be isomorphic to the class group of a corresponding cubic order. This is a cubic analogue of Gauss's theory of composition for binary quadratic forms and its relation to ideal classes of quadratic orders. The talk is based on Bhargava's “Higher composition laws II: On cubic analogues of Gauss composition.”

- **March 2**
  Jonathan Doane (Binghamton University)
  Affine duality, indeed

  Abstract: Rings with unity and bounded lattices have two underlying monoid structures - one with 0 and another with 1. There are exactly four twice monoid structures for which $\{0,1\}$ can be equipped; two of these actually resemble Boolean rings (BRs), one is a bounded distributive lattice (BDL), and the last is an elementary Abelian 2-group with 1, called $\textbf{A}$. Since BRs and BDLs are dualizable to Boolean spaces and Priestley spaces, respectively, it is natural to ask whether or not $\textbf{A}$ is dualizable as well. The aim of this talk is to answer this question in the affirmative.

- **March 9**
  Heiko Dietrich (Monash University)
  An update on group isomorphism

  Abstract: In this talk I will present some results of an ongoing project with James Wilson (Colorado State University) on the group isomorphism problem (which asks whether two given groups are isomorphic). For example, we have shown that group isomorphism is “easy” for almost all group orders. While the latter result is for the Cayley table model, I will also report on some more practical results: if time permits, then I will comment on cubefree groups, C-groups, and some groups of 'small order type'. The latter is joint work with my former Honours student Darren Low and current MPhil student Eileen Pan.

- **March 16 at 4:15 PM in the Arithmetic Seminar**
  Fikreab Admasu (Binghamton University)
  Bhargava's composition law for binary cubic forms, part 2

  Abstract: This is a continuation of the talk from February 23 with a focus on illustrative examples and some questions.

- **March 23**
  No Seminar

- **March 30**
  Zekeriya (Yalcin) Karatas (University of Cincinnati Blue Ash College)
  Structure of groups whose proper subgroups are of a certain type

  Abstract: One of the attractive general problems in the area of group theory is determining the structure of groups whose proper subgroups are of a certain type. The history of these types of problems goes back to Dedekind and Baer. The first known example is the structure of the groups whose all proper subgroups normal which was given by Dedekind and Baer. The types of conditions used for the subgroups were generalized more and increased by time which made these problems attractive and challenging. In this talk, I will give the history of

these type of problems including the most significant results and some possible open problems. I will also present our recent results in this area. Slides of the talk.

- **April 6**
  Justin Lynd (University of Louisiana at Lafayette)
  Punctured groups for exotic fusion systems

  Abstract: The fusion system of a finite group G at a prime p is a category whose objects are the subgroups of a fixed Sylow p-subgroup S, and where the morphisms are the conjugation homomorphisms induced by the elements of G. The notion of a saturated fusion system is abstracted from this standard example, and provides a coarse representation of what is meant by the p-local structure of a finite group. Once the group G is abstracted away, there appear many exotic fusion systems, namely fusion systems which do not arise in the above fashion. Given an exotic fusion system, one might like to ask: just how “group-like” is it? I'll present one answer to this question, look at examples such as the Benson-Solomon exotic fusion systems at the prime 2, and mention an application to the topology of classifying spaces. Slides of the talk.

- **April 13**
  Martino Garonzi (Universidade de Brasília)
  Elements pairwise generating the symmetric groups of even degree

  Abstract: In this talk I will present a recent work joint with F. Fumagalli and A. Maróti where we compute the maximal size of a subset S of the symmetric group G=Sym(n) (of even degree n at least 26) with the property that any two elements of S generate G. In particular, we show that it equals the covering number of G. Arxiv link Slides of the talk. Recording

- **April 20**
  No Seminar

- **April 27**
  Mandi A. Schaeffer Fry (Metropolitan State University of Denver)
  The McKay–Navarro Conjecture: The Conjecture That Keeps on Giving!

  Abstract: The McKay conjecture is one of the main open conjectures in the realm of the local-global philosophy in character theory. It posits a bijection between the set of irreducible characters of a group with p’-degree and the corresponding set for the normalizer of a Sylow p-subgroup. In this talk, I’ll give an overview of a refinement of the McKay conjecture due to Gabriel Navarro, which brings the action of Galois automorphisms into the picture. A lot of recent work has been done on this conjecture, but possibly even more interesting is the amount of information it yields about the character table of a finite group. I’ll discuss some recent results on the McKay—Navarro conjecture, as well as some of the implications the conjecture has had for other interesting character-theoretic problems. Slides of the talk. Recording

- **May 4**
  Bettina Eick (Technische Universitat Braunschweig)
  Groups and their integral group rings (Joint work with Tobias Moede)

  Abstract: The integral group ring ${\mathbf Z}G$ of a group G plays an important role in the theory of integral representations. This talk gives a brief introduction to this topic and then shows how such group rings can be investigated using computational tools. In particular, the quotients $I^n(G)/I^{n+1}(G)$, where $I^n(G)$ is the

n-th power ideal of the augmentation ideal $I(G)$, are an interesting invariant of the group ring ${\mathbf Z}G$ and we show how to determine them for given n and given finitely presented G. We then exhibit a variety of example applications for finite and infinite groups G.

- **May 11**

Lucas Gagnon (University of Colorado Boulder)

Gluing Supercharacter Theories and pre-GGG Characters

Abstract: Understanding the representation theory of the maximal unipotent subgroups in a given type of finite classical group is essentially impossible. Since these subgroups control a significant amount of the representation theory of said classical group, it is desirable to approximate these representation theories in some way. Supercharacter theory is a framework for doing this, but the ``how to'' of building a supercharacter theory to any meaningful specification remains somewhat mysterious. In this talk I will show how to construct a supercharacter theory from a lattice of normal subgroups and certain data on subintervals of this lattice, much like the gluing lemma in topology. By varying the lattice and interval data, it is possible to customize the resulting supercharacter theory as needed. To complete the story, I will show how the right choice of “gluing supercharacter theory” offers a new perspective on the Generalized Gelfand-Graev (GGG) representations of a finite classical group.

- **May 18**

Hatice Mutlu-Akaturk (University of California, Santa Cruz)

Monomial posets and their Lefschetz invariants

Abstract: The Euler-Poincare characteristic of a given poset X is defined as the alternating sum of the orders of the sets of chains $\mathrm{Sd}_n(X)$ with cardinality $n+1$ over the natural numbers n. Given a finite gorup G, Thevenaz extended this definition to G-posets and defined the Lefschetz invariant of a G-poset X as the alternating sum of the G-sets of chains $\mathrm{Sd}_n(X)$ with cardinality $n+1$ over the natural numbers n which is an element of Burnside ring $B(G)$. Let A be an abelian group. We will introduce the notions of A-monomial G-posets and A-monomial G-sets, and state some of their categorical properties. The category of A-monomial G-sets gives a new description of the A-monomial Burnside ring $B_A(G)$. We will also introduce Lefschetz invariants of A-monomial G-posets, which are elements of $B_A(G)$. An application of the Lefschetz invariants of A-monomial G-posets is the A-monomial tensor induction. Another application is a work in progress that aims to give a reformulation of the canonical induction formula for ordinary characters via A-monomial G-posets and their Lefschetz invariants. For this reformulation we will introduce A-monomial G-simplicial complexes and utilize the smooth G-manifolds and complex G-equivariant line bundles on them.

- Pre-2014 semesters
- Fall 2014
- Spring 2015
- Fall 2015
- Spring 2016
- Fall 2016
- Spring 2017
- Fall 2017

- Spring 2018
- Fall 2018
- Spring 2019
- Fall 2019
- Spring 2020
- Fall 2020

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