Saturday October 5

SESSION A: SAT OCT 5

4:40 − 5:00
Presenter(s): Shanna Dobson (California State University, Los Angeles)
Title: *Crystalline topos and the profinite completion of the adic Fargues-Fontaine curve*

Abstract: We interpret Gaitsgory and Arinkin's notions of crystals and cohomological support of coherent sheaves on a locally complete intersection scheme as a profinite completion of the adic Fargues-Fontaine Curve, where the perfectoid field $\mathcal{C}_*$ is replaced by a perfectoid space $\mathcal{S}$ of characteristic p. Since the category of crystals is equivalent to that of $\mathcal{D}$-modules, we leave open the question of how can we think of the Hochschild homology of equivariant $\mathcal{D}$-modules on a smooth variety in terms of a pro-crystalline topos, where crystals on X are quasi-coherent sheaves on the de Rham prestack X_{dR}.
Talk theme(s): Pure Mathematics, Arithmetic Geometry
Audience: Number Theory

5:10 − 5:30
Presenter(s): Nathan Carlson (California Lutheran University)
Title: *Connections between Furstenberg's and Euclid's proofs of the infinitude of primes*

Abstract: In 1955 Furstenberg gave a surprising topological proof of the infinitude of primes using arithmetic progressions. At first glance the proof seems unusual and unlike other proofs of this famous theorem. Cass and Wildenberg (2003) and Mercer (2009) gave non-topological versions of Furstenberg's proof that uncovered the essential number theory used in that proof. Yet on the surface neither version seems to bear much resemblance to Euclid's original proof. In this talk we give a variation of the Furstenberg/Mercer proof that in fact looks much like that classical proof. This demonstrates that while Furstenberg's proof seems unusual, at its core it is in fact quite similar to the first and most well-known.
Talk theme(s): Number Theory, Topology
Audience: Exposure to elementary number theory and topology

5:40 − 6:00
Presenter(s): Niraek Jain-Sharma (University of California, Berkeley)
Other Author(s): August Liu (Cambridge University), Tanmay Khale (Lafayette College). Research advisor: Peter Mága (Budapest Semesters in Mathematics)
Title: *Explicit Burgess bound for composite moduli*

Abstract: Let χ be any Dirichlet character with modulus q. Sums of the form $S(M, N) := \sum_{n=M+1}^{M+N} \chi(n)$, known as *character sums*, arise naturally in many number-theoretic contexts, such as in the study of quadratic non-residues, primitive roots, and Dirichlet L-functions. Bounds on character sums can be directly

translated to useful bounds in each of these situations. In his 1962 paper "On Character Sums and Primitive Roots, D.A. Burgess proved an epsilon bound on short character sums for any character χ with a prime modulus p; shortly thereafter, in two other papers, Burgess extended this result to composite moduli as well. However, the composite moduli bounds were never made explicit. In this paper, we work out and present several explicit versions of Burgess' result for any modulus $q > 2$.

Talk theme(s): Analytic Number Theory

Session B: Sat Oct 5

4:40 − 5:00
Presenter(s): Shane Orona (San Diego City College), Angel Hernandez Llamas (San Diego City College)
Other Author(s): Research advisor: Dr. Rob Rubalcaba (San Diego City College)
Title: *Creating an environment for students to help students*
Abstract: Professors often ask us to utilize tutoring resources, but how can you make us truly *want* to go to tutoring, and how do you offer us genuine support in our Math classes? At San Diego City College, we have several late night Math Jams throughout each semester. As a student in advanced math classes, at the Math Jams I get to both learn from student tutors in classes above me and tutor students in courses at or below the class I am taking. In tutoring/teaching math, it helps to refresh my memory with math that I had previously learned, but hadn't used in a long time. At the Math Jams, I also get to learn from other students that once struggled as I do now, which lets me know that it is possible to overcome challenges. It also validates my own feelings of being lost at times, which is sometimes all a student needs. As many students who experience anxiety before exams, Math Jams allow students to know that they are not alone with their feelings, which gives us the boost we so desperately need to keep going and succeed for one another.
Talk theme(s): Peer Tutors
Audience: Undergraduate students, educators

5:10 − 5:30
Presenter(s): Monica Dabos (California State University, Channel Islands)
Title: *Overcoming the challenges and understanding the benefits of teaching statistics today*
Abstract: Many of the challenges of teaching statistics are obvious to those teaching the subject today. However, how to address those challenges and explore the benefits of teaching statistics may be less obvious and not so easy to identify. In this talk, a multidimensional perspective to understanding the challenges that statistics teaching faces today will be presented. Understanding the different dimensions will help educators to recognize the consequences that those challenges have on students' success. A set of solutions will be proposed and together we will explore further ideas and solutions. At the same time,

this talk will present a comprehensive picture of the benefits, significance and importance of teaching statistics in our modern age.
Talk theme(s): Statistics Education
Audience: Those interested in teaching and learning of statistics

5:40 − 6:00
Presenter(s): Rob Rubalcaba (San Diego City College)
Title: *Eliminating the equity gap in mathematics*
Abstract: We show how to *eliminate* (not just address or reduce) the equity gap in Math, which is the gateway for STEM related majors and careers. Through culturally relevant pedagogy and equity minded practices from Umoja (Kiswahili word meaning unity) and the Puente Project (puente is Spanish for bridge), the achievement of African American and Latinx students in Mathematics has skyrocketed at City College over the past three years. Classes with 90-100 percent success rates in Intermediate Algebra, where students must master a departmental final just to pass are the norm in City College Umoja/Puente classrooms. In the short time we have, we will discuss a few key practices that anyone can use in any classroom (including advanced math) if your heart is in the right place, students of color can sense inauthentic care from miles away.
Talk theme(s): Equity Gap, Culturally Relevant Pedagogy
Audience: Undergraduate students, educators

Session C: Sat 10/5

4:40 − 5:00
Presenter(s): Maria van der Walt (Westmont College)
Title: *EMD with shape-preserving spline interpolation*
Abstract: Empirical mode decomposition (EMD) is a popular, novel, user-friendly algorithm to decompose a given signal into its constituting components, utilizing spline interpolation. In this paper, we equip EMD with a shape-preserving interpolation scheme based on quadratic B-splines. Using numerical experiments, we show that our scheme, which we coin Geometric EMD, or GEMD, outperforms the original EMD, both qualitatively and quantitatively.
Talk theme(s): Applied Mathematics
Audience: Linear Algebra, Calculus

5:10 − 5:30
Presenter(s): Christina Pospisil (University of California, Los Angeles)
Title: *Generalization theory for linear algebra I: an embedding algorithm and an appropriate inverse for non-injective mappings in one dimension*
Abstract: An algorithm for multiplying and adding matrices regardless of dimensions via an embedding is presented. An equivalent embedding for a general determinant theory is also investigated (Part I: Appropriate Inverses for non-injective mappings in one dimension are presented). In future work there will be applications to physics and other natural sciences be explored
Talk theme(s): Linear Algebra

5:40 − 6:00

Presenter(s): Melissa Gutierrez Gonzalez (Occidental College)
Other Author(s): Research Advisor: Dr. Pamela E. Harris (Williams College). Research conducted as part of the Mathematical Sciences Research Institute Undergraduate Program (MSRI-UP)
Title: *Weight q-multiplicities for representations of the exceptional Lie algebra* $\mathfrak{g}_2$

Abstract: In combinatorial representation theory, Kostant's partition function counts the number of ways a given weight of a Lie algebra $\mathfrak{g}$ can be written as a non-negative integral linear combination of the positive roots of $\mathfrak{g}$. Although it is very difficult to give a general closed formula for Lie algebras of arbitrary rank, are are motivated by previous successes in low rank cases and present a closed formula for Kostant's partition function for the exceptional Lie algebra $\mathfrak{g}_2$. We then use this result to present a closed formula for the q-multiplicity formula in this Lie algebra.
Talk theme(s): Combinatorics