UNIVERSITY OF MICHIGAN
Department of Mathematics

Seminar & Events Bulletin: Student Arithmetic

01-01-2013 to 06-30-2013

Wednesday, January 16, 2013	
3:00pm-4:00pm	**Student Arithmetic** -- () *Organizational meeting* -- 4096 East Hall

Wednesday, January 23, 2013	
3:00pm-4:00pm	**Student Arithmetic** -- Zach Scherr (UM) *Linear Forms in Logarithms* -- 3866 East Hall

Wednesday, January 30, 2013	
3:00pm-4:00pm	**Student Arithmetic** -- Robert Walker (UM) *The Saga of Fermat's Last Theorem* -- 3866 East Hall

Wednesday, February 06, 2013	
3:00pm-4:00pm	**Student Arithmetic** -- Jake Levinson (UM) *Local fields and Galois representations* -- 3866 East Hall

Wednesday, February 13, 2013	
3:00pm-4:00pm	**Student Arithmetic** -- Ari Shnidman (UM) *Galois representations and their deformations* -- 3866 East Hall

Wednesday, February 20, 2013	
3:00pm-4:00pm	**Student Arithmetic** -- Gene Kopp (UM) *Zagier's Magic Formulas for Real Quadratic Fields* -- 3866 East Hall

Wednesday, February 27, 2013	
3:00pm-4:00pm	**Student Arithmetic** -- Brandon Carter (UM) *The Herbrand-Ribet Theorem* -- 3866 East Hall

Wednesday, March 20, 2013	
3:00pm-4:00pm	**Student Arithmetic** -- Julian Rosen (UM) *TBA* -- 3866 East Hall

Wednesday, March 27, 2013	
3:00pm-4:00pm	**Student Arithmetic** -- Suchandan Pal (UM) *TBA* -- 3866 East Hall

Wednesday, April 03, 2013	
3:00pm-4:00pm	**Student Arithmetic** -- Adam Kaye (UM) *Damerell's Theorem on L-functions of Elliptic curves with CM* -- 3866 East Hall

Wednesday, April 10, 2013	
3:00pm-4:00pm	**Student Arithmetic** -- Hunter Brooks (UM) *TBA* -- 3866 East Hall

Wednesday, April 17, 2013	
3:00pm-4:00pm	**Student Arithmetic** -- Corey Everlove (UM) *Generalized prime numbers and integers* -- 3866 East Hall

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Abstracts

Student Arithmetic
Wednesday, January 16, 2013, 3:00pm-4:00pm
4096 East Hall
()
Organizational meeting

Student Arithmetic
Wednesday, January 23, 2013, 3:00pm-4:00pm
3866 East Hall
Zach Scherr (UM)
Linear Forms in Logarithms

In this talk I will describe the best known result about Alan Baker's linear forms in logarithms. This result is one of the few effective methods in the area of diophantine approximation. Several applications to diophantine equations will be given.

Student Arithmetic
Wednesday, January 30, 2013, 3:00pm-4:00pm
3866 East Hall
Robert Walker (UM)
The Saga of Fermat's Last Theorem

In this talk, we cover highlights in the saga of solving FLT (especially the investigations of Mazur, Frey, Serre, Ribet, and Wiles). More than that, we expect to motivate (most of) the key constructions involved in that line of investigation, in anticipation of more in-depth talks given by Ari and Jake.

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Student Arithmetic
Wednesday, February 06, 2013, 3:00pm-4:00pm
3866 East Hall
Jake Levinson (UM)
Local fields and Galois representations

The goal of this talk is to present some of the tools from Galois theory and class field theory used to study the absolute Galois group of Q and its representations, a key component of the Shimura-Taniyama conjecture. We'll mainly be comparing the structure of the absolute Galois group of the rationals to the Galois groups of local (or even finite) fields, which are much simpler to describe. We'll also give a complete description (from class field theory) of one-dimensional representations of these groups using the so-called cyclotomic character. Time permitting, we'll briefly touch on general Galois representations, especially two-dimensional l-adic reps, since these are the specific representations used in the modularity conjecture.

Student Arithmetic
Wednesday, February 13, 2013, 3:00pm-4:00pm
3866 East Hall
Ari Shnidman (UM)
Galois representations and their deformations

I hope to give an introduction to Mazur's method of deforming Galois representations and to explain how it is used in Wiles' proof of the modularity conjecture for semistable elliptic curves.

Student Arithmetic
Wednesday, February 20, 2013, 3:00pm-4:00pm
3866 East Hall
Gene Kopp (UM)
Zagier's Magic Formulas for Real Quadratic Fields

If K is an imaginary quadratic field, the zeta function $\zeta_K(s,A)$ of an ideal class A of $\mathcal{O}_K$ is essentially a real analytic Eisenstein series. Instead let K be real quadratic; this is no longer the case. However, an elementary trick due to Hecke expresses $\zeta_K(s,A)$ as the integral of real analytic Eisenstein series over a geodesic in the upper half plane. We will discuss (and sketch the proof of) some mind-blowing formulas of Meyer and Zagier relating the constant term of $\zeta_K(s,A)$ at $s=1$ to the periods of continued fractions. Connections will be drawn to the Stark conjectures and Hilbert's Twelfth Problem.

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Student Arithmetic
Wednesday, February 27, 2013, 3:00pm-4:00pm
3866 East Hall
Brandon Carter (UM)
The Herbrand-Ribet Theorem

Kummer proved that Fermat's Last Theorem holds for so-called regular primes and introduced "Kummer's Criterion": a prime p is irregular if and only if p divides the numerator of some Bernoulli number B_{2k} with $2 < 2k < p - 1$. In 1932, Herbrand showed that if the Galois group of $\mathbb{Q}(\zeta_p)/\mathbb{Q}$ acts on a subgroup of order p in the ideal class group in a prescribed fashion, then p divides a specific Bernoulli number. Nearly 45 years later, Ribet was able to prove the converse to Herbrand's theorem, using Eisenstein series, modular forms, the Eichler-Shimura relation, and Galois representations to explicitly construct an unramified cyclic extension of degree p over $\mathbb{Q}(\zeta_p)$ with the desired behavior.

In this talk we will discuss the relationships established between these tools and sketch Ribet's proof, with some difficulties black-boxed. As time permits, we will discuss connections to Vandiver's conjecture.

Student Arithmetic
Wednesday, March 20, 2013, 3:00pm-4:00pm
3866 East Hall
Julian Rosen (UM)
TBA

Student Arithmetic
Wednesday, March 27, 2013, 3:00pm-4:00pm
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Suchandan Pal (UM)
TBA

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Student Arithmetic
Wednesday, April 03, 2013, 3:00pm-4:00pm
3866 East Hall
Adam Kaye (UM)
Damerell's Theorem on L-functions of Elliptic curves with CM

Proven in 1970, Damerell's theorem finds the "algebraic part" of certain L-functions attached to elliptic curves with complex multiplication. It was studied in an attempt to make steps toward proving the BSD conjecture, but we will use it to interpolate special values of these L-functions to create p-adic L-functions.

Student Arithmetic
Wednesday, April 10, 2013, 3:00pm-4:00pm
3866 East Hall
Hunter Brooks (UM)
TBA

Student Arithmetic
Wednesday, April 17, 2013, 3:00pm-4:00pm
3866 East Hall
Corey Everlove (UM)
Generalized prime numbers and integers

The positive integers are a multiplicative semigroup generated by the prime numbers. In 1937, Beurling introduced "generalized integers," formed by taking the multiplicative semigroup generated by a sequence of positive real numbers called "generalized primes." What properties does a system of generalized integers have to satisfy in order for the classical Prime Number Theorem to hold? Can we construct a system of generalized integers for which the Prime Number Theorem holds but the Riemann Hypothesis fails? Answering these questions helps us understand which properties of the usual integers are used in the proof of the PNT and which properties will need to be accounted for in order to improve the PNT. I will give a survey of results of Beurling, Diamond, Malliavin, and others. Proofs will be sketched.