Archived Colloquia
2013/14

September 27, 2013: Deena Schmidt (Case Western Reserve University)

Title: ***Network Structure and Dynamics Involved in Sleep-Wake Regulation*** (Flyer)

Abstract: It is well known that mammals and other animals cycle between periods of sleep and wakefulness. Sleep and wake states are each maintained by activity in a corresponding network of neurons in the brain, with mutually inhibitory connections between the networks. In infants, the durations of both sleep and wake states follow an exponential distribution, but in adults the wake states have a heavy-tailed distribution. Is it the altered network structure or a change in neuronal dynamics that drives this transformation during development? We use mathematical models and random graph theory to explore this issue and the mechanisms of transition between sleep and wake states.

November 1, 2013: Larry Cusick (CSUF)

Title: ***Archimedean Quadrature Redux*** (Flyer)

Abstract: Archimedes' use of Eudoxos' method of exhaustion to determine the area bounded by a parabolic arc and a line segment was a crowning achievement in Greek mathematics. The promise of the method, so apparent to us now, seems to have died with Archimedes, only to rise again in different form some 1900 years later with the modern calculus. Archimedes' result though is not just about computing an area. It is about comparing a parabolic area with a related triangular area. That is, there is a geometric content in the comparison that is interesting in its own right. In this talk we would like to make the case that Archimedes' area comparisons deserve more attention, not so much because of his methods, but rather because of the interesting geometric content of the comparisons and the new questions they suggests. We feel that there are more results to be had, and present a few here with some speculation on further research directions.

December 6, 2013: Stefaan Delcroix (CSUF)

Title: ***Bertrand's Postulate*** (Flyer)

Abstract: In 1845, Joseph Bertrand conjectured what is now known as Bertrand's Postulate:

For all $n > 1$, there is at least one prime number between n and $2n$.

Bertrand was not able to prove his conjecture. It was proved by Chebyshev (1850), Ramanujan (1919) and Erdős (1932) but their proofs used rather advanced techniques in number theory. We will prove the following generalization:

Let $k \geq 1$.Then for any $n \geq max\{4000, 41k^2\}$, there are at least k primes between n and $2n$.

The proof we present here is elementary but extremely elegant and follows Erdős (1934). It is included in Proofs from THE BOOK. In this talk, we hope to convince students that plenty of topics in number theory are accessible to undergraduate and graduate students.

February 14, 2014: Roummel Marcia (University of California, Merced)

Title: ***Linear algebra, sparsity, and compressed sensing*** (Flyer)

Abstract: Knots are terribly interesting mathematical objects that have been studied rigorously since about the last century. An attempt at classification of knots was originally motivated by a misguided connection between knots and chemistry, but we have since learned of many useful applications of knot theory in the sciences. One important application is in the study of DNA replication in biology. The use of knots as models of DNA inspired a new notion of a knot-like object called a pseudodiagram.
Since their introduction in 2009, we have discovered many interesting properties of pseudodiagrams. We were also led to invent a bonafide knot theory called Pseudoknot Theory. In this talk, we will learn what is known about pseudodiagrams and pseudoknots. We will pay special attention to interesting obstructions to unknotting pseudoknots.
This talk will be accessible to undergraduates.

April 4, 2014: Allison Henrich (Seattle University)

Title: ***What is a Pseudoknot?*** (Flyer)

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May 2, 2014: Rolando Pomareda (Universidad de Chile)

Title: ***Unitals in projective planes*** (Flyer)

Abstract: One of the most important subjects in finite geometry is the study of finite projective planes. One of the ways to do this is to study interesting structures that live on the plane to be studied. One of these structures is a unital. Unitals are found only in certain projective planes, and are one of the extremal objects with the property of intersecting all lines of the plane. The expectation is that a characterization of unitals will necessarily carry important information about the planes that host them.
We will start by introducing what projective planes and unitals are. We will then explore a

classification of unitals by considering the set of lines, through a point exterior to the unital, that are tangent to the unital.