UNIVERSITY OF OREGON

DEPARTMENT OF MATHEMATICS

2009 MOURSUND LECTURES

November 10th-12th

TERENCE TAO, 2006 FIELDS MEDAL RECIPIENT
UNIVERSITY OF CALIFORNIA, LOS ANGELES

Lecture 1: **Recent Progress in Additive Prime Number Theory**
4:00 p.m., Tuesday, November 10th, 2009 - McKenzie 129

Abstract: Additive prime number theory is the study of additive patterns in the primes. We survey some recent advances in this subject, including the results of Goldston, Pintz, and Yildirim on small gaps between primes, the results of Green and myself on arithmetic progressions in the primes, and the results of Bourgain, Gamburd, and Sarnak for detecting almost primes in orbits.

Lecture 2: **Compressed Sensing**
4:00 p.m., Wednesday, November 11th, 2009 - McKenzie 221

Abstract: Suppose one wants to recover an unknown signal x in R^n from a given vector Ax=b in R^m of linear measurements of the signal x. If the number of measurements m is less than the degrees of freedom n of the signal, then the problem is underdetermined and the solution x is not unique. However, if we also know that x is _sparse_ or _compressible__with respect to some basis, then it is a remarkable fact that (given some assumptions on the measurement matrix A) we can reconstruct x from the measurements b with high accuracy, and in some cases with perfect accuracy. Furthermore, the algorithm for performing the reconstruction is computationally feasible. This observation underlies the newly developing field of _compressed sensing_. In this talk we will discuss some of the mathematical foundations of this field.

Lecture3: **Discrete Random Matrices**
4:00 p.m., Thursday, November 12th, 2009 - McKenzie 221

Abstract: The spectral theory of continuous random matrix models (e.g. real or complex gaussian random matrices) has been well studied, and very precise information on the distribution of eigenvalues and singular values is now known. But many of the results rely quite heavily on the special algebraic properties of the matrix ensemble (e.g. the invariance properties with respect to the orthogonal or unitary group). As such, the results do not easily extend to discrete random matrix models, such as the Bernoulli model of matrices with random ±1 signs as entries. Recently, however, tools from additive combinatorics and elementary linear algebra have been applied to establish several results for such discrete ensembles, such as the circular law for the distribution of eigenvalues, and also explicit asymptotic distributions for the least singular values of such matrices. We survey some of these developments in this talk.

A tea will precede Wednesday's lecture at 3:30 p.m. & a reception will follow Thursday's lecture.
Both tea and reception will be held in 219 Fenton Hall.