

THURSDAY, AUGUST 14

All talks on Thursday will be in *Eckhart 206*. Lunch and tea will be in the tea room.

11:15am: Central simple algebras (Noah Schweber). Central simple algebras form a particularly nice class of algebras over a given field. The properties of these algebras can be and have been studied from many different perspectives, including group cohomology, algebraic geometry, and K-theory. In this talk, I will define central simple algebras, explain why we care about them and their connection to matrix algebras, briefly cover the relation between CSAs and group cohomology, and mention the main idea of the relation between CSAs and algebraic geometry. The main results I will cover are: a characterization of CSAs in terms of twisted forms of matrix algebras; the proof that the set of CSAs (with the right equivalence class) forms an abelian group under the tensor product; and the fact that the set of CSAs which split over a given field is canonically isomorphic to a particular first cohomology set.

12:00pm: Lunch.

1:00pm: The Stable Roommates Problem (Nathan Schulz). The stable roommates problem as originally posed by Gale and Shapley in 1962 involves a single set of even cardinality $2n$, each member of which ranks every other member in order of preference. A stable matching is then a partition of this single set into n pairs such that no two unmatched members both prefer each other to their partners under the matching. In the talk, I will discuss Irving's algorithm that determines if a stable matching is possible on a given set, and if so, finds such a matching.

1:45pm: Genetic Programming (Joseph Doliner). Genetic Programming is a new subfield of Artificial Intelligence, computer programs are considered as organisms and subjected to simulated reproduction and natural selection to find solutions to challenging problems. We'll discuss the frequent stumbling block of locality and an interesting modification to attempt to circumvent this problem.

2:30pm: Reflection groups, lattices and the Monster (Tathagata Basak). We shall talk about reflection groups and symmetries of lattices and other discrete symmetries in nature. Here are some of the things we'll find along the way:

- (1) The list of regular four dimensional polytopes (with pictures).
- (2) The densest way to pack spheres in dimension 24.

We may even get to a strange simple group with about ten to the fifty four elements acting on a vector space of dimension 196883, known as the monster.

3:30pm: Tea.

4:00pm: The Grigorchuk Group (Caitlin Waddle). I will define the Grigorchuk group and prove some of its properties. The Grigorchuk group is an interesting example in geometric group theory. It has the surprising property of being finitely generated and every element has finite order, but the group itself is infinite.

4:45pm: Combinatorics and Straight Lines on Surfaces (Ian Biringer). A quirky theorem from the 1960's says that among the set of points on the circle obtained by rotating a given point by a fixed angle some number of times, there are at most 3 distinct real numbers that occur as distances between a point and its nearest neighbor. We will play a similar game, but instead of working on the circle we will drop breadcrumbs at regular intervals while walking in a 'straight line' that winds around the surface of some more complicated object, and then look at the distances between pairs of nearest neighbor crumbs.