Fall 2016

Course No. 846

Course title: Hopf algebras in Combinatorics

Time: 11:00 MWF

Location: B235 Van Vleck

Instructor: Paul Terwilliger

Prerequisite: A good understanding of undergraduate linear algebra.
We do not assume prior knowledge of Hopf algebras.

Textbook: Darij Grinberg and Victor Reiner. Hopf algebras in Combinatorics.
These notes are freely available at arXiv:1409.8356v4 (August 2016)

DESCRIPTION: Many types of algebras that you may be familiar with,
have an extra structure that makes them a Hopf algebra. For example
group algebras, Lie algebras, and the ring of symmetric functions.
In this course, we will see how Hopf algebras come up naturally
in combinatorics. We will investigate a number of combinatorial
situations that yield concrete and attractive examples of Hopf algebras.
These examples help to illuminate how Hopf algebras work in general.
The course topics include:

The definition and basic facts about Hopf algebras
The ring of symmetric functions as a Hopf algebra
The Cauchy product
The Hall inner product
The skew Pieri rule
Positive self dual Hopf algebras
The representation theory of the symmetric group; a Hopf algebra approach
The Hall algebra
Quasisymmetric functions and P-partitions
Shuffles and Lyndon words
The shuffle algebra