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.


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