TOPICS IN TOPOLOGY
MATH 752
SPRING 2017

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Course info: MWF 10:00-10:50, 335 Whitehall Classroom Building.

Hopf algebras first arose in algebraic topology as it was noticed that the cohomology ring of a Lie group has an additional "comultiplication" which interacts well with the cup product. Since that time, Hopf algebras have been studied in many fields, including algebraic geometry, representation theory, quantum topology, and algebraic combinatorics.

We will start with examples, including group rings, tensor algebras, and symmetric algebras. Next, we will discuss some structural results, which describe the form that a Hopf algebra may take. In some cases, the subHopf algebras of a given Hopf algebra can be characterized. In more detail, some topics to be covered include

Topics:

(1) Milnor-Moore Theorem
(2) SubHopf algebras and classification
(3) The Hopf algebra of Quasi-symmetric functions
(4) The Steenrod Algebra
(5) Hopf algebra cohomology
(6) Hopf Algebroids

Time permitting, we will discuss some applications to the stable homotopy groups of spheres.

Text: There is no *required* text for this course. Here are some good resources we may consult from time to time:

- *A primer of Hopf Algebras*, by Cartier.
- *More Concise Algebraic Topology* (esp. part 5), by May and Ponto.
- *Hopf Algebras in Combinatorics*, course notes by Grinberg and Reiner.
- *Cohomology Operations and Applications in Homotopy Theory*, by Mosher and Tangora (Dover).

Homework: Homework exercises will be assigned occasionally to solidify the material in the lectures. You are **strongly** encouraged to work in groups on the homework, but you must write up your solutions independently.

Prerequisites: MA 651. MA 654 recommended.