

# ALGEBRA SEMINAR

## *The Cobar-Bar Construction and Quasi-Isomorphism for Algebras, II*

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ABSTRACT: The Cobar and Bar constructions are classical constructions in homological algebra; Eilenberg-MacLane's Bar construction takes an algebra and returns a cofree coalgebra, while Adams' Cobar construction takes a coalgebra and returns a free algebra. It is a classical result that the Cobar-Bar complex is quasi-isomorphic to the original algebra, but the proof of this fact is hard to come by in the literature. In these lectures, a proof of this quasi-isomorphism will be given using Hochschild cohomology. The first lecture will introduce the Hochschild chain complex of a cofree coalgebra, and finish with a proof that it is almost acyclic. The second lecture will introduce both the Bar and Cobar constructions, and using results from the first talk, prove the Cobar-Bar quasi-isomorphism. These talks will be self-contained, and accessible to graduate students of all levels and backgrounds.

MONDAY, SEPTEMBER 19, 2011  
1:40 – 2:30 PM  
ROOM 617, WACHMAN HALL  
DEPARTMENT OF MATHEMATICS