Math 8190: Representations of Algebraic Groups
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A major problem in modular representation theory has been the determination of a character formula and the dimensions of finite dimensional simple modules over a connected reductive algebraic group. Lusztig conjectured that the character could be computed recursively in terms of ``Kazhdan-Lusztig'' polynomials. These polynomials arise from the Hecke algebra associated with the Weyl group of the given algebraic group.

One of the goals of this course is to intoduce the terminology and ideas used in formulating the Lusztig conjecture. For this purpose most of the material will be taken from Jantzen's ``Representations of Algebraic Groups''.

The possible topics include:
Kempf's vanishing theorem, Bott-Borel-Weil theorem, Weyl's Character Theorem, representations of Frobenius kernels G_{r} and related module categories $G_{r}T$ and $G_{r}B$, Strong Linkage Principle, injective G_{r} modules, Steinberg's twisted tensor product formula, and the Translation Principle. Other related topics might also include cohomology for infinitesimal Frobenius kernels and support varieties for restricted Lie algebras.

In this course we will use an interesting mix of tools from both algebra and algebraic geometry.

Recommended reading list:

J.E. Humphreys, Introduction to Lie Algebras and Representation Theory, Springer-Verlag, 1970.

J.C. Jantzen, Representations of Algebraic Groups, American Math. Soc., 2004.

W.C. Waterhouse, Introduction to Affine Group Schemes, Springer-Verlag, 1979.