Course Information

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Introduction. Sheaves on topological spaces are an important tool in many different areas of mathematics. "Perverse sheaves" are the objects of a category that is closely related to the category of sheaves. Constructing this category is rather difficult, but the payoff is enormous: in many ways, perverse sheaves have better properties and are easier to work with than ordinary sheaves, and a number of important advances in mathematics in the past 25 years could not have taken place without them.

Outline. Most of the semester will be spent developing the background needed to define and establish the basic properties of perverse sheaves. In the last few weeks of the semester, we will look at a few of their applications. A tentative schedule for the semester is as follows (each numbered entry stands for one week):

A. Sheaves
1. Definition and basic properties
2. f_*, f^{-1}, $\mathcal{H}om$, and sheaf $\otimes$
3. Local systems and constructible sheaves
4. $f_!$; adjointness properties

B. Derived categories
5. Definition and basic properties
6. Axioms for triangulated categories
7. Derived functors
8. Rf_*, f^{-1}, $R\mathcal{H}om$, $\otimes^L$, $R\mathrm{Hom}$, $R\Gamma$
9. $f^!$; adjointness properties

C. t-structures and perverse sheaves
10. Definition and basic properties
11. Perverse t-structure; examples
12. Intersection cohomology complexes

D. Applications
13. Springer correspondence
14. TBA

Website. The course webpage is at http://www.math.lsu.edu/~pramod/7280/. All class materials will be posted on this page.

Homework. This will be a "seminar-type" course, and the required homework will be quite minimal. I will post a problem set of suggested problems on the website once every week or two, but it is only necessary to hand in three problems (of your choosing), one from each of Parts A, B, and C of the course (as in the above outline). However, I encourage you to at least try thinking about as many of the problems as you have time for. You may hand in as many problems as you like, of course.

References. There is no required text for the course. An excellent reference on sheaves and derived categories is

M. Kashiwara and P. Schapira, *Sheaves on Manifolds*, Grundlehren der Mathematischen Wissenschaften, Springer-Verlag, Berlin, 1990.

This book does have a chapter on perverse sheaves as well, but it doesn't cover the middle-extension functor or intersection cohomology complexes.

The authoritative reference on perverse sheaves is still the monograph in which the theory was first developed:

A. Beilinson, J. Bernstein, P. Deligne, *Faisceaux pervers*, in *Analyse et topologie sur les espaces singuliers, I (Luminy, 1981)*, Astérisque **100**, 1982.

I will post other references on the website during the semester, and I may also hand out photocopies of articles or my own notes from time to time.