Mathematics 583DA
Special Topics: Model Categories
Spring 2004

Lecture time and place: MWF 11:30, PDL C-401

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Text: Mostly, I'll use *Model Categories* by Mark Hovey. Otherwise, I'll provide references.

Homework: There may be occasional homework problems. Feel free to work with other people on the homework. If you find a solution in a book, please provide a reference.

Grading: To get a 4.0, attend class regularly and make a reasonable attempt on half of the homework problems. To get a grade in the range 3.6–3.9, do less than that. If you never show up and do less than a tenth of the homework, I might have to give you a lower grade than that, or perhaps an "X".

Introduction: Model categories provide a good way of inverting a class of maps and studying the result; the basic examples are homotopy theory (the original motivating example) and derived categories. Simplicial technology is important throughout topology and algebra; historically, simplicial sets came first, and are important in homotopy theory. (In particular, one can do homotopy theory in the category of simplicial sets, and one can use model categories to show that it is equivalent to doing homotopy theory with CW complexes.) Simplicial groups, simplicial vector spaces, indeed simplicial objects in any category arise fairly naturally, and so are a good thing to study.

Plan for the course: I will discuss model categories and simplicial sets. I will start with the definition of a model category and its homotopy category, and also discuss a bunch of examples, both algebraic and topological. As I do the examples, I will discuss good ways of constructing model category structures, and in particular, cofibrantly generated model categories.

Prerequisites: You will need to be comfortable with basic homological algebra: chain complexes, projective and injective modules, things like that. You need to know some basic category theory (the definitions of category and functor should almost be enough). You should also be familiar with basic point-set topology.