Math 8245 Group Theory Fall Semester 2018

When: 2:30 - 3:20 Monday, Wednesday, Friday
Instructor: Peter Webb, http://www.math.umn.edu/~webb

Course Content and Goals
One goal, especially at the beginning, is to study core topics in group theory that go beyond what is taught in Math 8201/2 but which are widely useful and should be known by every well-educated group theorist. The other goal is to present more advanced and specific topics. I intend everything we study either to be interesting and useful in its own right, or else a result we need to get to something else.

For the first 10 weeks or so of this semester there will be two parallel courses, one theoretical, the other dealing with computational group theory using the computer system GAP. The theoretical side will be taught two days each week, and on the third day we will meet in a computer classroom.

Familiarity with computer methods is essential these days. To use the computers you will need a math dept account. No prior programming experience is necessary. We will start by learning the basics of the language which GAP uses, and go on to learn how to do computations with groups given as permutation groups, by presentations, and as matrix groups. As part of this we will learn how the algorithms we use work, and thereby gain some insight into their limitations. GAP is also available in SAGE, but in order to use any except the most rudimentary commands you need to know what they are in GAP.

On the theoretical side we will start with some basics of group theory: semidirect products, wreath products, Sylow subgroups of symmetric groups, actions on sets, semidihedral, dihedral and quaternion groups, groups of order the cube of a prime. We will then study stabilizer chain algorithms, the Todd-Coxeter algorithm for coset enumeration, uses of Sylow's theorem beyond Math 8201, nilpotent groups, Bass-Serre theory (groups acting on trees).

Where we go after that, mainly in the second semester, will be influenced by class interest. The topics we will select from include Coxeter groups, Garside theory, groups with a BN-pair, group cohomology, crystallographic groups, introduction to finite simple groups, aspects of representation theory.

Texts and sources
There will be no text to purchase. I will give handouts.

Prerequisites
The group theory from Math 8201 is sufficient