Math 8246 **Group Theory** **Spring Semester 2019**

Instructor

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Office Hours: MWF 11:15 - 12:50 or by appointment.

Course Content and Goals

We will start the semester with the cohomology of groups, focusing on the definitions and interpretations of the low-dimensional groups. After that we will study groups with a BN pair and buildings.

Texts

There will be no text to purchase: I will distribute notes. You may find the following books helpful. The first four are entirely about group cohomology:

K.S. Brown, Cohomology of Groups, Graduate Texts in Math. 87, Springer-Verlag 1982.
K.W. Gruenberg, Cohomological Topics in Group Theory, Lecture Notes in Math. 143, Springer-Verlag 1970.
J.F. Carlson et al, Cohomology of finite groups, Kluwer 2003.
A. Adem, R.J. Milgram, Cohomology of finite groups, Springer, 2004.

The following have sections on group cohomology:

C.A. Weibel, An introduction to homological algebra, Cambridge University Press, 1994.
P. Hilton & U. Stammbach, A course in homological algebra, Graduate Texts in Mathematics 4, Springer 1997.
D.S. Dummit and R.M. Foote, Abstract Algebra, Wiley.
J.J. Rotman, Advanced modern algebra, Prentice Hall, 2002.
D.J. Benson, Representations and cohomology I, Cambridge 1991.

For crystallographic groups I have found the following book useful as a source for the theory:
H. Brown et al, Crystallographic groups of four-dimensional space, Wiley 1978.

Syllabus for cohomology of groups

Basic homological algebra.
Projective resolutions, Ext, extensions of modules.
Definitions of group cohomology. The available resolutions.
Interpretations of low dimensional groups: the Schur multiplier, group extensions, the first homology and cohomology groups.
Relations with subgroups: the Schur - Zassenhaus theorem.
Applications: crystallographic groups
Possibly further topics such as ring structure, methods of computation.

Course Assessment

There will be 4 or 5 homework assignments during the course of the semester. If you make a genuine attempt at 50% or more of the questions you will get an A for the course. You do not have to obtain correct solutions to these questions, only make genuine attempts (in my opinion).

I believe that it is extremely difficult to obtain a sound and permanently lasting command of the material presented without doing some work which actively involves the student. It should be possible for everyone who wishes to obtain an A on this course.

Expectations of written work

Most of the time in the conventional homework problems, to satisfy my criterion of making a genuine attempt you will need to write down explanations for the calculations and arguments you make. Where explanations need to be given, these should be written out in sentences i.e. with verbs, capital letters at the beginning, periods at the end, etc. and not in an abbreviated form.
I encourage you to form study groups. However everything to be handed in must be written up in your own words. If two students hand in identical assignments, they will both receive no credit.

Prerequisites

The content of the Math 8200 algebra sequence is sufficient as a prerequisite. It will be helpful to know some of the things done in Math8245 last semester, notably things to do with free groups, but this is not essential. It will also be helpful to know the homological algebra from Math8301/2 and about the definition of homology of spaces, but again this is not essential. The things we need will be in my notes, and it will be possible to pick them up quickly.

Incompletes

These will only be given in exceptional circumstances. A student must have satisfactorily completed all but a small portion of the work in the course, have a compelling reason for the incomplete, and must make prior arrangements with me for how the incomplete will be removed, well before the end of the quarter.

Date of this version of the schedule: 1/16/2019