

ES.S20: Group Theory

Course Description

Logistics

This special MIT seminar — offered by the Experimental Study Group (ESG) — meets in 24-618 from 11:00 a.m. to 12:30 p.m. on Mondays and Wednesdays over IAP 2025. The seminar begins Monday, January 6, and ends Wednesday, January 29. (There will be no meeting on Monday, January 20, which is Martin Luther King, Jr. Day.)

Instructor: Dr. Gabrielle Stoy (gstoy@mit.edu)

Teaching Assistant: Titus Roesler (tkr@mit.edu)

There is no course website. All readings, worksheets, and other course materials will be sent to students by e-mail.

Overview

The meetings of the seminar will be interactive. You are expected to participate in discussions and do the worksheets in small groups with help from Gabrielle and Titus. There will not be homework, but there will be reading (which you are expected to do) in preparation for each meeting. Gabrielle will begin the seminar by presenting and talking about the reading. No prior knowledge of group theory is required. The discussion will be at a level where everyone can learn and participate.

Grading

This is a 2-unit seminar graded on a pass-or-fail (P/F) basis. The requirement for obtaining a passing (P) grade is that you attend the seminar, prepare for class discussions by doing the reading, and participate in class discussions of the worksheets. There are seven scheduled class meetings. You will be allowed two excused absences from the seminar. Please talk with Gabrielle if this is a problem.

Textbook

Groups and Geometry. Peter M. Neumann, Gabrielle A. Stoy, Edward C. Thompson. Oxford Science Publications. (There are a few new copies lying around ESG. Please keep them in ESG. Do not take them outside with you.)

Aims

The overall aim of this seminar is that everyone attending learns something about the importance of group theory.

- Get to know some specific groups by working with them.
- Understand some general concepts as applied to group theory.
- Appreciate groups as another algebraic structure.
- Discuss and work with the material at an appropriate level and speed for you.

There will be one worksheet per week. Each worksheet will have a different focus. An outline of the focus for the four weeks is as follows.

Week #1: 01/06 and 01/08

Introduction to basic ideas of group theory. Examples of some specific groups: matrix groups and permutation groups.

Week #2: 01/13 and 01/15

Structure of groups, subgroups, Sylow subgroups, normal subgroups.

Week #3: 01/22

Simple groups and A_5 . Groups acting on a set.

Week #4: 01/27 and 01/29

Analyze the rotations of a cube. How many essentially different ways are there of coloring a cube red, white, and blue so that each face is painted with one color?