MAT301: Groups and Symmetries

Course Syllabus. University of Toronto. Summer Session 2017.

Logistics.

Instructor

Anne Dranovski (adranovs@math.toronto.edu).

Office hours

Tentatively Wednesday 1:15-3:15pm (in Bahen 4010); or contact me by email to make an appointment.

TAs

Patrice Moisan-Roy (patmroy@math.utoronto.ca) and

Mateusz Olechnowicz (mateusz@math.utoronto.ca).

Class schedule

Wed 10-11, Fri 10-12.

Textbook

Gallian, Contemporary Abstract Algebra. I will reference the 8TH edition.

Our platforms

Blackboard, Crowdmark.

Deadline to drop this course

July 16.

Prerequisites

Background for the course and general information: Due to the course prerequisites, students should already be familiar with the following topics:

1. Matrix multiplication, determinants and matrix inverses (mainly for 2×2 matrices);
2. Properties of integers, including greatest common divisor (gcd);
3. Modular arithmetic;
4. Functions.

Topics 2–4 are discussed in Chapter 0 of the text. Some examples involving modular arithemetic will be presented in class. (Students who are not familiar with the above topics are advised to spend some time learning about them.) Proofs of various theorems will be discussed in class, along with many examples that do not appear in the text. On quizzes and tests, there will be a few simple proof questions, along with many concrete questions involving specific examples. Students will not be asked to prove theorems from the course on quizzes or on tests.

Accessibility needs

If you require accommodations for a disability, or have any accessibility concerns about the course, the classroom or course materials, please contact Accessibility Services as soon as possible: disability.services@utoronto.ca or http://studentlife.utoronto.ca/accessibility.

Code of behaviour

Students should become familiar with and are expected to adhere to the Code of Behaviour on Academic Matters: http://www.governingcouncil.utoronto.ca/policies/behaveac.htm.

Course structure.

Classroom time

Lectures will follow a *Example–Abstraction–Computation* progression, with emphasis on examples and computations to motivate the abstraction. Tutorials will take you through assignment questions. All four hours of class time are equally important.

Homework

Some problems will be assigned at the end of every class. Think of them as pieces of a longer assignment which you don't leave to the last minute, but work on continuously. These assignments will not be collected. Instead, approximately every other week you will write an assignment-based quiz in the last 15 minutes of tutorial. The quiz will consist of two or three assigned problems. You will solve one of them. 10 minutes will be enough time to solve one *iff* you have solved all of them already.

Midterms

There will be three midterms, *tentatively* in weeks 5, 9 and 13. I will announce the exact dates and the test structure in class and on Blackboard.

Content objectives of the course.

Dihedral, cyclic, permutation and linear groups. Cosets, normal subgroups and quotient groups. Factor groups and direct products. Conjugacy classes. Sylow's theorem. Fundamental theorem of finite abelian groups. Special topics. The following is a rough approximation of the path we will take. Note: tests will be written in the first hour of Friday lecture.

Week	Topic	Ref	Tutorial
1	Groups and subgroups.		–
2	Dihedral groups.		Quiz 1 (May 24)
3	Cyclic groups.		–
4	Lagrange's theorem.		Quiz 2 (Jun 7)
5	The symmetric group. Test 1 (Jun 16).		–
6	The parity of a permutation. 15 puzzle.		–
7	Break.		–
8	Normality of A_n & quotient groups.		Quiz 3 (Jul 5)
9	Review. Simplicity of A_n. Test 2 (Jul 14).		–
10	Groups of order $2p$ and finite abelian groups.		–
11	Conjugacy classes. Burnside's theorem.		Quiz 4 (Jul 26)
12	Sylow's theorems and/or Symmetries in 2D.		–
13	Review. Symmetries in 2D/3D. Test 3 (Aug 11).		Quiz 5 (Aug 9)

Evaluation

The final mark will consist of $^{1.5}/_{7}$ parts quizzes (best 4 out of 5) plus $^{0.5}/_{7}$ parts one assignment (administered via crowdmark and marked out of 2 for clarity and completeness), $^{p}/_{7}$ parts midterms and $^{q}/_{7}$ parts final exam, where $p + q = 5$ and $p =$ *the number of tests*.

Missed midterms

There will be no make-up tests. A student who misses a test without providing valid documentation (for example, a properly completed U of T verification of student illness or injury form; see below for more details) within one week of the test will receive a mark of 0 on the test. If a student misses a test for a valid reason and provides a hard copy of valid documentation, that student's mark will be redistributed according to the $p + q = 5$ formula.

Valid documentation for a student who misses the term test due to illness: the documentation must indicate incapacity and give the dates or period affected. A doctor's note with "patient was ill" or "patient off work" scribbled on a prescription pad will not be accepted. The medical certificate must indicate that the doctor diagnosed and treated you when you were ill: it cannot just report that you told the doctor after the fact that you had been ill previously. Generally, an illness must be severe enough that it prevents you from writing an exam. For example, a headache is not sufficient to warrant absence. The only accepted document is a fully completed University of Toronto Verification of Student Illness or Injury form. (A copy of this form can be found at `http://www.illnessverification.utoronto.ca/`). The original of the form (not a photocopy or scan or fax) must be submitted. It must be completed by a medical doctor (not an acupuncturist, chiropractor, or other health care professional).