

Syllabus for Math 3175 Spring 2011. Prof. A. Iarrobino

Text: *Contemporary Abstract Algebra*, 7th ed. J. Gallian, Brooks-Cole
ISBN: 13:978-0-547-16509-7

(you may use 6th edition, but will have to check or copy some HW).

ClassPac: Will be available from Reprographics (behind bookstore) about January 17. Worksheets, Sample quizzes, exams, some with solutions. References. About \$10.

Prerequisite: Linear algebra MTH 2331, and Calculus 3 MTH 2321.

Helpful: Math 1365, Introduction to Mathematical Reasoning.

Time: Monday, Wednesday, Thursday 9:15-10:20 AM. **Room:** 1 Snell Library

Instructor: Prof. Anthony Iarrobino, 526 NI, x 5524, e-mail a.iarrobino@neu.edu
(e-mail is usually a very quick way to contact me, please address "Prof. Iarrobino" and also indicate clearly who you are as sender.)

Office Hours: Mon. 11:50-12:10, 3:15-4:30 PM, Wed 1:30-3:00 PM, Thurs 1:30-3 PM or by appointment. (I am frequently in as late as 5:30 Mon, Wed, Thurs, but some of that is scheduled).

Spring 09 Class notes website: Brief synopsis of some classes, HW assignments, additional resources, announcements. <http://www.math.neu.edu/~iarrobino/AlMathU575Spr09classnotes.html>

Spring 11: I will use Blackboard or e-mail for occasional announcements rather than a web page.

Grading: HW: Some will be collected and scored. **Quizzes:** about 4-5, drop the lowest. The average of the quiz grades, together with a contribution from collected HW and Extra Credit HW (see below) and class participation is 40% of the course grade. A Goal C essay/report will count as one quiz grade, more if it becomes a project. The one-hour **midterm exam** is 20%. A **Final exam** (day TBA) is required of all, and will count 40%. Optional work such as a **project or presentation:** may be used for up to 20% of your before FE grade, if arranged with instructor by March 9.

HW: I will assign homework, primarily from the syllabus below and the Class Pac. I plan to collect on alternate Thursdays the HW assigned Wed-Thurs of previous week, and Monday of current week: I plan to score 4 problems 2 pts each and 2 pts for completeness. At the final exam, you may pass your collected HW or notebook to be checked for an Extra Credit HW grade.

You are encouraged to study with others, and to discuss HW with others, but HW passed in should be your own work. I will discuss this expectation more in class.

Journal: An optional weekly journal about your math work/thoughts kept either physically and passed in with HW, or kept online may count as EC, and if you wish I will comment.

Class work, etc. in small groups: Part of most classes will be devoted to solving problems in group theory related to HW. We may work in small groups. Also students may choose to do optional presentations or projects as a group.

Topics: The course introduces the basic ideas and applications of group theory, including symmetry groups, abelian, cyclic, and permutation groups. Also subgroups, normal subgroups, group homomorphisms, quotient groups, direct products, group actions on a set, and an introduction to Sylow theorems. The theory will be illustrated by examples from geometry, linear algebra and combinatorics. We will cover chapters 1-10, 29 of text, also topics from Chapters 11, 24-27 as time permits. We will emphasize group action on a set as a unifying theme (see Class Pac).

Goals: A. Students will understand the basic ideas and some applications of groups. Students will be able to explain groups and factor groups and their relation to symmetry. Students will recognize mathematical objects that are groups, and be able to classify them as abelian, cyclic, direct products, etc. Students will understand homomorphism of and quotients of groups, and be able to determine when a group has a normal subgroup, or a quotient.

B. Students will be able to reason mathematically, to write simple proofs, and are able to judge when an attempted proof in group theory is correct and complete or is not.

C. Students will have a chance to reflect on doing mathematics, solving problems and our role and progress as mathematicians.

Homework exercises from text (7th edition). Instructor will make assignments. CP=class packet

Chapter	Topic	Pages	Problems
0	Preliminaries: GCD, LCM, proofs	21	1,2,4,7,8,9,11,14,20,22,53,54
WS	On proofs	CP p, 4,5	#4A,B,C
1	Examples of symmetry groups	35	5,13,17,19,20,22
2	Definition and examples of groups	52	1-8
	Elementary Properties of groups	52	9,14,15,16,20,23,25,32,34
3	Finite groups, subgroups	64	1,2,3,10,12,18,19,20,23,26,30
	“ “ of $GL(2,R)$ general linear group	67	36,37,38,39,46,47,48,51,59,60.
WS	Group Actions on a set. Orbit, stabilizer	CP 9-10	WS 1.5 Exercises
4	Properties of Cyclic Groups	81	1-10,14,21,26,28
	Classification of subgroups of cyclic groups	83	36-39,46-48,51,59,60
	Cyclic groups and supplementary exercises	91	1,2,3,9,18,22,23,24
5	Permutation groups, cycle decomposition	113	1-9,17,18,23,24,25,
	Permutation groups, stabilizer, application	115	27,28,31,33,43,58,59
6	Isomorphisms	133	1-10,14,24,25
	Isomorphisms: $Aut(G)$, $Aut(Z_n)$	134	27,29,32,35,37,39,40,47
WS	Thurston article: read on ArXiv	CP p.22	Goal C essay.
7	Cosets and Lagrange's Theorem	149	1-9,13,15,16,18,25,26
	Groups of order $2p$; rotation groups	150	34,35,38,39,45,46,48,50
8	External direct products	174	1-13,16,18,20,22,24,26,27,44, 45,46,49,53
	Supplementary Exercises	174	5,10,13,14,25,26,35
11	Fundamental Theorem of Abelian groups	226	1,3,4,5,7,13,15,16,17,19,21. Q5Spr08 #1, FE Spr 09 #3 ExtraQuizSpr08 #3.
9	Normal subgroups, define factor group G/N	193	1,2,3,4,5,6,8, 10
	Factor Groups G/N	193	14,16,17,18,27,28,29,30,32,34
	Orders of elements in G and G/N Center $Z(G)$, and $G/Z(G)$.	195	37,38,40,45,46,49,50,51,53,54, 65,66,68
10	Homomorphisms, kernel, and image	211	5,7-27,54,55,56,62
29	Symmetry and Counting	494	1-15
	CP: Worksheet 4a,4 (Burnside Thm)		CP WS4 #4
24* optional	Class equation, Sylow theorems	415	5-8,10-14,16-22,24-
	Sylow and Group structure		28,30,31,46,47
	Applications of Sylow to determine groups	CP	CP p. 20-21
	Groups actions on a set and proof of Sylow	CP	CP p. 19-20

Readings: I will assign some readings relevant to Goal C, in particular W. Thurston, “On Proof and Progress in Mathematics” Bull Amer Math Soc 30 #2, April 1994, 161-177. (available free online at the math ArXiv). Students are invited to suggest others.

Academic Honesty: It is fine to work together to do homework (studies have shown this can be particularly helpful in learning math), provided such assistance is acknowledged specifically in any work passed in, and that you understand what you pass in. Collaboration on quizzes and exams is not allowed, unless I make a specific exemption for a quiz, announced in advance. *In any presentation or project, resources used and sources of assistance must be acknowledged in a professional way.*

Student Code of Conduct: see <http://www.northeastern.edu/osccr/academichonesty.html> or Student Handbook p. 36 <http://www.northeastern.edu/admissions/pdfs/UndergradHandbook.pdf> states:

A commitment to the principles of academic integrity is essential to the mission of Northeastern University. The promotion of independent and original scholarship ensures that students derive the most from their educational experience and their pursuit of knowledge. Academic dishonesty violates the most fundamental values of an intellectual community and undermines the achievements of the entire University.”

The website/handbook goes on to detail examples. In Math 3175, academic dishonesty on a quiz or exam, or assignment leads to a zero on the quiz or exam or assignment that cannot be made up, as well as a letter detailing the incident to the Office of Student Conduct and Conflict Resolution. The minimum penalty for a finding of academic dishonesty by the student Conduct Board includes one year suspended probation.

Incomplete grade: requires a written understanding (contract) between the Instructor and student with details about what material will be made up and how. Incompletes are normally appropriate only for a student who is doing well, but who becomes ill, or has a family emergency late in the semester.

Concerns and conflicts: In case of concerns about the course that cannot be resolved by speaking with the instructor, please contact the Mathematics Department Undergraduate Director, Professor D. King, 437 Lake Hall, Phone 617-373-5679, e-mail d.king (at) neu.edu.

FE: Day, time, TBA. All students will be expected to take the Final Exam as scheduled, your travel plans at the end of the semester must take the FE into account.