MA 405, Abstract Algebra
Worcester State University, Spring 2018

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office hours:
Mondays 10:25 – 11:25, Tuesdays 1:00 – 2:00, Wednesdays 1:00 – 2:00,
and by appointment or luck (you are welcome to stop in anytime).
website: http://www.hyginsberg.com

Meetings: MWF 9:30 – 10:20, S-123.

Prerequisites: MA-240 with a grade of at least B- and MA-260 with a grade of at least C-.

Content: The study of groups, rings, and fields. Topics will include subgroups, cyclic groups, permutation groups, homomorphisms and isomorphisms, normal subgroups, quotient groups, integral domains, ideals, polynomial rings, extension fields, and finite fields.

Text: Any edition of *Contemporary Abstract Algebra*, by Joseph A. Gallian.

Technology: You will be required to prepare some of your homework exercises using LaTeX, a modern, textbook-quality typesetting system specially designed for mathematical documents. The computers in Sullivan 138 have MikTeX (a LaTeX distribution for Windows) installed; LaTeX distributions can also be downloaded and installed on your personal computer (PC, Mac, or Linux) for free. Further information and guidance will be provided in class (and an introductory document is available on the class website).

Homework: Homework will be assigned and collected frequently, and is of fundamental importance to your success in the class. Please either leave very wide margins or skip lines so that I may easily add comments.

You are strongly encouraged to work together on homework assignments, but *all submitted work must be your own.* Please take advantage of my office hours for help with homework problems (or, if those times are not convenient, make an appointment with me or just stop in).

You may not research homework problems online; doing so will be considered academic dishonesty and dealt with accordingly.

After your homework has been graded and returned, you are invited to correct your mistakes and resubmit the assignment for partial credit on any improvements. To do so, rewrite the exercises you wish to correct and hand them in *with the original homework.*

You will be awarded 70% of any additional points you earn on resubmission. *Rewrites will only be accepted within two weeks of the date the assignment is resturned to the class.* If there are still problems to correct, you may resubmit the homework a second time for 40% of any additional points earned (second rewrites will be accepted within four weeks of the date the original assignment is returned to the class). Homeworks due late in the semester will have less time for rewrites; no rewritten homeworks will be accepted after the last day of class, May 7th.

In case of illness or other absence, please email your homework before the start of class. Late homeworks will be penalized.

Midterms: There will be two midterm exams, both of which will be administered across two consecutive classes. The first is tentatively scheduled for Wednesday, March 7th and Friday, March 9th; and the second for Wednesday, April 18th and Friday, April 20th; but these may be rescheduled to better fit the timing of the course, if necessary. You might be able to talk me into a make-up exam if you have a good enough reason; if you care to try, let me know as soon as possible.

Final: The final exam is cumulative, and will be held on Monday, May 14th, from 8:30 PM to 12:30 PM, in our usual classroom (according to the schedule set by the registrar).

Grading: This is a proof-based class; most of your homework and exam problems will require written proofs, which will be graded primarily based on the correctness and completeness of the arguments, but also to some degree on the quality of the writing and of the presentation – one of our goals in all of our work will be *to write beautiful mathematics*.

Your grade will be calculated as: 20% for each of the two midterm exams, 30% for your homework average, and 30% for your final exam.

Grades will not be curved or rounded, and final letter grades will be assigned as follows:

	$B^+ \geq 87$	$C^+ \geq 77$	$D^+ \geq 67$
$A \geq 93$	$B \geq 83$	$C \geq 73$	$D \geq 63$
$A^- \geq 90$	$B^- \geq 80$	$C^- \geq 70$	$D^- \geq 60$

Attendance: You are expected to attend *every* class. If you must miss a class, *you are still responsible for the material we cover.* In particular, you are expected to read the textbook, get the class notes, and do the homework so that you are caught up with the rest of the class when you return.

Academic Honesty: You are expected to uphold the university's high standards of academic honesty at all times. Please see the *Student Handbook* on the Student Services page for details. All incidents of academic dishonesty will be reported to the Academic Judicial Board.

Accommodations: If you anticipate issues related to the format or requirements of this course, please meet with me as early as possible in the semester to discuss ways to ensure your full participation. If you believe that formal, disability-related accommodations are appropriate, it is very important that you register with Student Accessibility Services (SAS) and notify me of your eligibility for such accommodations. We can then plan how to best coordinate your accommodations. SAS is located in the Administration Building, Room 131 and can be reached by phone ((508)929-8733) or email (sas@worcester.edu).

Credit hours: Inherent in the idea of a credit hour is the expectation that for each hour of class time the student will spend a minimum of two hours outside of class on homework, studying, reading the text, and similar activities. This is a three credit course; you should spend at least six hours per week outside of class working on the class material.

Approximate Schedule:

Week of	Topics
1/15	Groups, $\mathbb{Z}/n\mathbb{Z}$, $(\mathbb{Z}/n\mathbb{Z})^\times$.
1/22	Dihedral groups, subgroups, center, centralizer.
1/29	Cyclic groups, subgroup lattices, permutation groups.
2/5	Alternating groups, isomorphism, cosets, Lagrange's Theorem.
2/12	Direct products, normalizer, normal subgroups.
2/19	Quotient groups.
2/26	Homomorphisms, first isomorphism theorem.
3/5	Rings, integral domains, exam.
3/12	Fields, ideals, quotient rings.
3/19	Spring break.
3/26	Maximal and prime ideals, polynomial rings.
4/2	Irreducibility criteria.
4/9	Unique factorization domains, principal ideal domains, Euclidean domains.
4/16	Exam.
4/23	Finite fields, extension fields, splitting fields.
4/30	Algebraic extensions, algebraic closure.
5/7	Review.