

Math 463/563: Graduate Algebra I

MWF 9:00am - 9:50am, GRB W211. See Syllabus for details
 Instructor: Dr. Chelsea Walton. notlaw@rice.edu

[Final Version]

| Lecture # | Date | Algebraic Structure/ Broad Topic | Sub-topic (Notes in Dropbox folder) | Default: Section(s) of Dummit and Foote 3rd ed [supplementary material] | Homework Due Date Exam Date |
|------------|--|-------------------------------------|---|---|--|
| 1 | M 8/21/2023 | Intro/ Groups | Introduction to the course; Groups, examples of symmetries | Own notes; 1.1-1.5; | |
| 2 | W 8/23/2023 | Groups | Subgroups and Group morphisms; Groups generated by subsets | 1.6, 2.1; 2.3-2.5 | |
| 3 | F 8/25/2023 | Groups | Group Actions; Subgroups (arising from actions) | 1.7; 2.2 | HW #0 Due |
| 4 | M 8/28/2023 (ONLINE) | Groups | Quotient Groups; Cosets and Lagrange's Theorem; Products of Groups | 3.1; 3.2 | |
| 5 | W 8/30/2023 (ONLINE) | Groups | Isomorphism Theorems; Transpositions; Alternating Groups | 3.3; 3.5; 3.5, 4.6 | HW #1 Due |
| 6 | F 9/1/2023 (ONLINE) | Groups | Composition Series, Hölder Program Solvable, Nilpotent Groups | 3.4 | |
| 7 | W 9/6/2023 (after Labor Day) | Groups | Group actions via permutations; via left multiplication, Cayley's Theorem; via conjugation | 4.1; 4.2; 4.3 | HW #2 Due |
| 8 | F 9/8/2023 | Groups | Group actions continued, Class Equation; Automorphisms | 4.3; 4.4 | |
| 9 | M 9/11/2023 | Groups | Sylow's Theorems | 4.5 | |
| 10 | W 9/13/2023 | Groups | Sylow's Theorems | 4.5 | HW #3 Due |
| 11 | F 9/15/2023 | Groups | Direct Products; Fund. Thm of Fin. Gen. Abel. Grps | 5.1; 5.2 | |
| 12 | M 9/18/2023 | Groups | Fund. Thm of Fin. Gen. Abel. Grps; Semidirect Products | 5.2; 5.5 | |
| 13 | W 9/20/2023 | Groups | Semidirect Products | 5.5 | HW #4 Due |
| 14 | F 9/22/2023 | Groups | p-groups; Nilpotent Groups, Solvable Groups (revisited) | 6.1 | |
| 15 | M 9/25/2023 | Groups | Free Groups and Presentation of Groups | 6.3 | |
| 16 | W 9/27/2023 | Rings | Rings, Examples, Subrings Ring morphisms | 7.1, 7.2; 7.3 | HW #5 Due |
| 17 | F 9/29/2023 | Rings | Quotient Rings and Ideals | 7.3, 7.4 | |
| 18 | M 10/2/2023 | Rings | Rings of Fractions | 7.5 | |
| 19 | W 10/4/2023 | Rings | Euclidean Domains | 8.1 | |
| 20 | F 10/6/2023 | Rings | Principal Ideal Domains; Unique Factorization Domains | 8.2; 8.3 | HW #6 Due (A heavier assignment, due on a FRIDAY) |
| 21 | W 10/11/2023 (after Midterm Recess) (ONLINE) | Rings | Rings of the form $\mathbb{Z}[\sqrt{D}]$ | Ch 8 | |
| 22 | F 10/13/2023 (IN-PERSON EXAM) | | | | MIDTERM EXAM (through Oct 6th) |
| 23 | M 10/16/2023 | Rings | Polynomial Rings over Fields | 9.1, 9.2 | |
| 24 | W 10/18/2023 | Rings | Polynomial Rings that are UFDs Irreducibility Criterion | 9.3; 9.4 | HW #7 Due (This assignment will be lighter than usual.) |
| 25 | F 10/20/2023 | Rings | Irreducibility Criterion Sun-tzu's Remainder Theorem; Polynomial Rings over Fields | 9.4; 7.6; 9.5 | |
| 26 | M 10/23/2023 | Rings | Groebner Bases | 9.6** **Cox-Little-O'Shea 2.1-2.3 | |
| 27 | W 10/25/2023 | Rings | Groebner Bases inc. Hilbert Basis Theorem | 9.6** **Cox-Little-O'Shea 2.4-2.5 | HW #8 Due |
| 28 | F 10/27/2023 (ONLINE) | Rings | Groebner Bases | 9.6** **Cox-Little-O'Shea 2.6-2.8 | |
| 29 | M 10/30/2023 | Vector Spaces | Vector Spaces Vector Space morphisms Dual Vector Spaces | 11.1 11.2 11.3 | |
| 30 | W 11/1/2023 | Vector Spaces | Bilinear and Quadratic Forms | Jacobson 2ed 6.1-6.3 | HW #9 Due |
| 31 | F 11/3/2023 | Vector Spaces Modules | Bilinear and Quadratic Forms Modules, Examples, Submodules | Jacobson 2ed 6.1-6.3 10.1 | |
| 32 | M 11/6/2023 | Modules | Modules (motivation), Examples | 10.1 | |
| 33 | W 11/8/2023 | Modules | R-algebras, Modules morphisms, Quotient Modules | 10.2 | HW #10 Due |
| 34 | F 11/10/2023 | Modules | Generation of Modules, Direct Sums, and Free Modules; Tensor Products of Modules (motivation) | 10.3 10.4 | |
| 35 | M 11/13/2023 | Modules | Tensor Products of Modules | 10.4 | |
| 36 | W 11/15/2023 | Modules | Tensor Products of Modules | 10.4 | HW #11 Due |
| 37 | F 11/17/2023 | Modules | Linear Trans of Tens Prod of V.Spaces Modules over PID | 11.2 12.1 | |
| 38 | M 11/20/2023 | Modules | Modules over PID Canonical Forms | 12.1 12.2, 12.3 | |
| 39 | M 11/27/2023 (after Thanksgiving) | Modules | Canonical Forms | 12.2, 12.3 | |
| 40 | W 11/29/2023 | Modules Category Theory | Canonical Forms Categories, Functors, Equiv (briefly) | 12.2, 12.3 CW notes | |
| 41 | F 12/1/2023 | Category Theory | Categories, Functors, and Equivalence (briefly) | More in CW's Spring 2024 course! | HW #12 Due (due on a FRIDAY) |
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| Study Days | Sa 12/2/2023 - T 12/5/2023 | | | | |
| Final Exam | Take Home Final on Dec 7th, 2pm - 5pm | | | | FINAL EXAM (through Nov 29th) |