

**MATH 5310/20, MWF 12:55 - 1:45**

**0.1. Instructor.** Gordan Savin

Office: LCB 205

Office hours: MWF, 10:30-11:30, or by appointment

**0.2. Syllabus.** The text for this course sequence is Michael Artin's *Algebra*, Second Edition. You need to have this book. Math 5310 covers topics from Chapters 2 - 7, Math 5320 covers topics from Chapters 11 - 15.

**0.3. 5310 Topics.**

- (1) Groups, subgroups, homomorphisms.
- (2) Equivalence relations, cosets and conjugacy classes, theorem of Lagrange.
- (3) Modular arithmetic, fields and finite fields.
- (4) Normal subgroups, quotient group, and the first isomorphism theorem.
- (5) Vector spaces over a general field.
- (6) The meaning of row column operations, dimension of vector spaces.
- (7) Quotient spaces, their dimension (not in the book).
- (8) Linear transformations, a brief discussion of Jordan normal form.
- (9) Orthogonal transformations. Theorem of Euler for dimension 3.
- (10) Group actions, application to classification of finite subgroups in  $SO(3)$ .
- (11) The class equation and simplicity of icosahedral group.
- (12) The first Sylow theorem.

**0.4. 5320 Topics.**

- (1) Rings and ideals. Quotient rings. Product rings.
- (2) Field of fractions. Maximal ideals. Nullstellensatz.
- (3) Factorization. Euclidean domains.
- (4) Gauss's lemma and Eisenstein's criterion.
- (5) Modules and  $\mathbb{Z}$ -modules. Row column reduction over rings.
- (6) Noetherian rings.
- (7) Classification of finite commutative groups.
- (8) Vector space with a linear transformation: a module. Jordan decomposition.
- (9) Fields. Algebraic numbers.
- (10) Ruler and compass constructions.
- (11) Construction of finite fields.
- (12) Class group of quadratic rings.

**0.5. Exercises.** HW in boldface.

- Chapter 2: 1.1-3, 2.3, 2.4, 3.1, 3.2, 4.1-5, 4.8, 5.1, 5.2, 5.4, 5.6, 6.1, 6.2, 6.4-6, 6.8, 7.1, 7.2, 7.5, 8.1, 8.6, 8.7, 8.9, 8.11, 9.1-3, 10.3, 10.4, 11.1, 11.4, 11.9, 12.2, 12.4, 12.5.
- Chapter 3: 1.1, 1.2, 1.4, 1.5, 1.8, 1.11, 2.1, 2.2, 3.1, 3.2, 3.7, 4.1, 4.3, 4.4, 5.1.
- Chapter 4: 1.2, 1.3, 1.5, 2.1, 2.3, 3.1, 3.3, 4.1, 4.2, 4.3, 4.5, 4.6, 5.2, 5.3, 5.6, 6.2, 6.3, 6.4, 6.7, 6.8, 7.2, 7.3.
- Chapter 5: 1.1, 1.2, 1.3, 1.4.
- Chapter 6: 4.1, 4.2 (a), 7.1, 7.7, 7.9, 8.1, 8.4, 9.1, 9.2, 11.1, 11.3, 11.6, 12.3.
- Chapter 7: 2.1, 2.2, 2.7, 2.8, 2.14, 3.2, 3.3, 4.4, 4.5, 4.6, 6.2, 7.3, 7.5, 7.8.
- Chapter 11: 1.1, **1.3**, 1.8, **2.1**, 3.2, 3.3, **3.8**, 3.9, 3.12, **4.2**, **4.3**, 4.4, 5.1, **5.4**, 5.5, 6.1, **6.2**, 6.4, 6.5, 6.8, **7.1**, 7.2, 7.3, **8.2**, **8.3**. HW due 01/30/2012
- Chapter 12: **1.2**, 1.4, 2.1, 2.5, **2.6**, 2.8, **3.1**, 3.2, 4.1, **4.3**, **4.7**, 4.8, 4.9, **5.1**, **5.3**, 5.5, **5.7**. HW due 02/22/2012
- Chapter 14: **1.1**, **1.4**, **2.1**, **2.4**, **4.1**, **4.3**, **4.6**, **7.1**, **7.6**, **8.2**, **8.3**, 4.8, 5.2, 6.2, 7.5, 7.9. HW due 03/19/2012.
- Chapter 15: **2.1**, **2.2**, **3.1**, **3.2**, **3.3**, 3.4, **3.8**, **4.1**, **4.2**, 5.1, **5.3**, 7.2, 7.3, **7.4**, 8.2. HW Due 04/16/2012