MATH 311 (Sec. A)
Fall 2009

Instructor: Byung-Jay Kahng
Office: WT 304B
OH: TuTh 10:00–12:00, MWF 10:00–10:50,
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COURSE ANNOUNCEMENT

CLASSES: MTWF 1:00 – 1:50, at OM 214.

TEXTBOOK: T.W. Hungerford, *Abstract Algebra—An Introduction, 2nd Ed.*

OVERVIEW/ OBJECTIVES: Nowadays, (abstract) algebraic methods and terminologies are used almost everywhere in Pure and Applied mathematics, as well as Computer science, Physics, Coding theory, etc. This course introduces the students the axiomatic/abstract definitions of various algebraic structures, including "rings", "ideals", "fields", "groups". The main goals of the course are: (1) to explore the basic properties of these algebraic structures; (2) to learn about their uses in different settings in mathematics; and at the same time, (3) to develop the ability to work with such abstract concepts in formulating proper mathematical arguments.

Naturally, a strong emphasis will be given to writing logically proper proofs. For this, the students should learn to work with abstract axioms, and in addition, be able to convert heuristic and conceptual statements into logical and mathematically rigorous arguments.

PREREQUISITES: Passing grades in Math 230 and Math 219, or permission of the instructor. To be specific, you should be able to working with Equivalence relations; Mathematical induction; and Methods used in Linear Algebra.

FINAL EXAM: During the finals week. The date and time will be announced later by the College.

MIDTERM EXAMS: We will also have three midterm exams, in class.
The dates are: Sep 28 (Mon), Nov 3 (Tue), Dec 1 (Tue).

HOMEWORK: There will be regular homework assignments, usually once a week or so. While I may select to grade only a portion of the assigned problems, the homeworks play a very important role in an advanced course like this one. Please begin early and ask questions often. More detailed instructions on homeworks will follow.

QUIZ: Quizzes (short, $\leq$ 15 min.) will be given occasionally. They will be announced one class prior. The quizzes will be mostly about definitions or theorem statements, but may also include some computational ones. Once or twice, a more lengthened version (take-home Worksheet) may be given instead.

SEMINAR: Being in math upper-class, you are encouraged (strongly!) to attend and participate in the department-run student seminars. I will give you extra points for each attendance. Giving a talk will earn you a bigger bonus: It will be possible to bring your grade up in this way. If you wish to give a talk in one, and wish to work on an algebra topic in connection with our course, please come and ask: Earlier the better.

GRADING: Total (750^*) = HW&Q (225) + Att (50) + Mid (3×100) + Final (175).

(*) Some modifications to the above breakdown could be made.

ATTENDANCE/ BEHAVIOR: Students are expected to attend classes and engage themselves. Of course, it will matter to your overall grade. When you are in class, please be courteous to others (e.g. turn off your cell phones). Academic dishonesty/cheating is wrong, and should be avoided.

MAKE-UP POLICY: In principle, there will be no make-up exams, especially for the final exam. However, for some valid reason, if you have to miss an exam, please contact me for a special arrangement.

DIFFICULTIES: If you have any personal difficulties (learning disabilities, illness, or any emergency), let me know and we will try to make appropriate arrangements.

COURSE TOPICS: We will cover Chapters 1 – 6 (with some omissions) and the first several sections of Chapter 7.

- **Integer arithmetic:** Division algorithm; Greatest common divisor; Prime numbers; Unique factorization of integers into a product of primes
- **Modular arithmetic:** Congruence modulo n; Equivalence relations; Modular arithmetic
- **Rings:** Definition and Examples of rings; Fields; Homomorphisms and Isomorphisms of rings
- **Polynomial rings:** Arithmetic in polynomial rings; Irreducible polynomials; Unique factorization property of $F[x]$; Congruence
- **Ideals:** Ideals; Quotient rings; Homomorphisms; Isomorphism theorems; Prime and Maximal ideals
- **Groups:** Definition of groups and their general properties; Examples; Subgroups; Normal subgroups and Quotient groups

ADDITIONAL INFORMATION:

• Last day to drop/add classes is 8/29; Last day to withdraw from a course is 11/13.

• Homework assignments will be announced in class and posted also on the web (I will set up the course homepage at http://www.canisius.edu/∼kahngb/math09311.html). Many of them are proof problems, reflecting the nature of this course.

• When writing mathematical proofs, you should make an effort to use complete English sentences, proper grammar (mathematical as well as English), spelling and punctuation. Leave enough room for me to write comments/feedback on your proofs. Now you are in an upper-division course: Try also to make your presentation neat. It is very much all right (and encouraged) to work in groups, but you should write up your homework on your own, in your own words. This is very important in a course like this one.