Course Outline: Math 3320, Spring 2011

The web page for this course can be found at **http://livetoad.org/**. The same material will appear under My Courses at **https://myut.utoledo.edu/**, where you can also check your scores. Please visit frequently for announcements, changes, due dates, solutions, scores, and other goodies.

Introduction. Welcome to Abstract Algebra! Algebra is one of the oldest mathematical subjects. Every major ancient culture developed the rudiments of the algebra that is now taught in Middle and High Schools. This algebra was *algorithmic*, meaning concerned with step-by-step procedures. Examples include the manipulation of numerical expressions, and the solutions for linear and quadratic equations. This algebra was purely *rhetorical*, meaning it was written without any symbols except the numerals — and sometimes not even these. There were no symbols for addition or multiplication, for equality or for variables. Some of this was written in verse form. Through 2000 years of history every algebra problem was a "word problem"!

Eventually many cultures developed a *syncopated* style of writing algebra, meaning they used abbreviations for the variables and some of the operations and relations. This was particularly true in Renaissance Europe, where at the same time mathematicians began to ponder the structure underlying the problems and their solutions. This culminated in the development of a purely symbolic algebra in the 17th century. It also led to the first abstract algebraic structures ("groups") in the 18th century.

After this period mathematical discoveries accumulated quickly. The field of algebra increasingly turned from study of algorithms to the study of structure. In the 20th century the wide-ranging algebraic results and methods were shaped into a coherent theory called abstract algebra. This is now one of the three pillars on which almost all of modern mathematics is built. (The others are topology and real analysis.)

Very recently algebra has returned more and more to its roots, using abstract structures along with electronic computers to develop and study new algorithms.

Objectives and learning outcomes. In this course there are three major goals:

- To introduce algebraic structures and some of their applications.
- To survey the history of algebra.
- Above all, to develop the skill of writing clear mathematical proofs.

By the end of this course you should be able to do the following:

- Write clear and logically correct mathematical proofs.
- Derive basic facts about groups from the axioms.
- Correctly manipulate sets and set operations.
- Employ homomorphisms, conjugacy, and counting arguments in the analysis of groups.
- Identify major developments in the history of algebra and discuss their impact on modern mathematical curricula.

Since Math 3190 is a prerequisite for this course I know that you have already been exposed to proof techniques. We will further hone these skills.

Textbook. Our text is *Groups and Symmetry* by M A Armstrong. We will cover the first 20 chapters of the text, which means we will cover more than 1 chapter per week. Altho the chapters are quite short (typically around 3–5 pages) this pace will require you always to read a bit ahead of where we are currently.

Quizzes. There will be around 15 short 10-point quizzes this semester. I will not announce the dates of the quizzes ahead of time. On some quizzes you will be asked to write out verbatim definitions and theorems from the text. On some quizzes you will be asked questions based on the historical notes. Once we have covered a chapter in the book all definitions, theorems, and historical notes up to and including that chapter are fair game for any subsequent quiz. Your 10 best quiz scores will count towards your final grade.

Assignments. There will be around 14 written assignments with exercises taken from the text. Each exercise set will be worth 10 points. Your 10 best scores will count towards your final grade. Your work must be neat and show all work. When you turn in your work fold the papers lengthwise and write on the outside

your name, Math 3320, Spring 2011, *assignment number*, *due date*

Plagiarism. I encourage you to work together. Studies show that students who work together consistently out-perform those who do not. However your own work must be written in your own words. Do not "divide up the labor". Do not turn in work that is not your own. Copying is cheating. This includes copying from another student or copying from another textbook or a solutions manual. If you turn in work that is not your own then you will get a 0 on that assignment. If it happens a second time you will get an F in the course.

Exams. There will be 4 exams, worth 100 points each. The exam dates are listed on the calendar below and are posted on the web along with their syllabus. The exam questions will be similar to those found on the quizzes and homework assignments. Note that exam 4 is *not* a cumulative final exam. Your best 3 exam scores will count towards your final grade.

M L King Day	Monday, 16 January	*Last Day to Withdraw*	Friday, 23 March
Exam 1	Monday, 30 January	Exam 3	Monday, 2 April
Exam 2	Friday, 2 March	Exam 4	Wednesday, 2 May, 10:15
Spring Break	Monday–Friday, 5–9 March		

Absences and missed work. I will not accept assignments past the due date nor provide make-up quizzes or exams except in case of a documented exigency, such as illness or a funeral. If you are absent then you must call or email that same day if you expect to be able to make up the work for that day. If I am not in my office then you can leave a voice mail message. In particular if you fail to show up for an exam and do not contact me about it that same day then you will not be able to make up that exam — you will get a 0 for that exam. For more details on the UT Missed Class Policy see

http://www.utoledo.edu/facsenate/missed_class_policy.html

WAC designation. We will employ writing to enhance learning in several ways this semester.

- For each weekly assignment you will be asked to choose two proofs for rewriting and resubmission.
- You will be asked to review and edit the writing of your peers.
- In class we will review writing samples to discuss problems with clarity and organization and suggest improvements.
- At the end of each class each of you will be asked to take a minute to write one question left unanswered from the day's discussion. These will be addressed at the beginning of the next class.
- At the end of the semester you will be asked to write a 1–3 page assessment of your own learning outcomes, measured against the course objectives listed above.

For those of you enrolled in section 101 you will get credit for a WAC class. For you the writing assignments described above are *required*. If you are not in the WAC-designated section 101 then the above are only suggested and can be applied to your final grade as extra credit.

Grades. Your final grade will be determined from the distribution of total points earned, on the following scale:

90% earns an A; 80–89% earns a B; 70–79% earns a C; 60–69% earns a D.

If you stop attending class without withdrawing then you will get an F. I cannot issue a withdrawal or a W.

Office hours. My office is UH 2040. The phone number is 419 530 2138. My email address is simply paul.hewitt at utoledo.edu. My office hours are Mondays, Wednesdays, and Fridays 12:30–2:00. At these times you can call or stop by without an appointment and I am sure to be there. I am also available at other times, but for these you must make an appointment. Feel free to ask for appointments at other times if you cannot make it to my regular office hours. If you call me when I am not in my office then you can leave a voice mail message and I will get back to you as soon as I can.