MAT 4900: History of Mathematics

Professor: Charles Delman
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Office Hours: MTWR 3-4 p.m.

Text: *An Introduction to the History of Mathematics*, by Howard Eves (6^{th} edition), Thompson–Brooks/Cole.

1. Course Content, Objectives, and Approach

As you might imagine, mathematics has a long history, and it is impossible to cover it all in one semester! (Indeed, even the text does not cover all of it, as it is not up-to-date and it is also quite Eurasian-centric. Additional sources will be introduced as appropriate.) We will be selective, but try to touch on a variety of periods and topics. Our objective will be to understand something about the historical development of mathematics, its fields, and its methods, in the context of the cultures in which they developed. Our approach will be to understand mathematical developments by *doing* mathematics: expect plenty of problems to solve, and many of these problems will be difficult! As a valuable side benefit, this course will enhance your ability to solve problems and think creatively in a variety of mathematical disciplines.

Do not expect this course to be easier than other advanced mathematics courses, just because it is a historical survey! It won't be!

2. Requirements

Class participation: You are expected to attend class, to read the relevant sources before class, and to work steadily on assignments. Be prepared to present your work and contribute to discussions.

Problem Sets: Written problem sets will be regularly assigned and graded, with comments. Doing the assignments is the primary tool for learning the material. The process outlined below is meant to ensure that you take the assignments seriously and obtain the maximum benefit from doing them.

You will be expected to turn in a draft of your solutions to each assignment, which will be returned with brief comments and symbolic markings indicating the location of common mistakes (see *Symbol Chart*) in a selection (possibly all) of the problems. You are expected to make this initial draft as good as possible. A final draft of your solutions will be due several days later. No assignment will be accepted for grading unless the initial draft has been turned in on time, and I reserve the right to refuse to accept your final draft if your initial draft shows insufficient care and effort.

An exclamation point ("!") at the top of your initial draft indicates that you *must* see me to discuss the assignment before your final draft will be accepted. (An exclamation point does not necessarily mean you have not put in enough effort; it just means you have made errors serious enough to indicate the need for one-on-one assistance.) *As noted above, the purpose of the process described here is that you will learn from doing the homework!*

I encourage you to work together and discuss the course material with each other. You may hand in joint papers with up to three authors, although given how important it is that each student gets a lot of practice in writing definitions and proofs, I recommend that you do so very sparingly. If you choose to write a joint paper, I strongly advise that you do not divide up the problems, but rather work on and discuss them all until you are satisfied with the solutions as you write them up. Give credit at the top to all of the authors, who will, of course, receive the same grade. (It is up to you to ensure that everyone contributes fairly. If your paper receives an exclamation point, you are all expected to come see me together.)

All assignments must be typeset using Tex. (Given that this is an upper-level course, by this point you should know Tex, but if you don't there are ample online resources.) The purpose of using Tex is three-fold: it is easier to revise your work, because you can cut, paste, and type without starting over; your work is easier to read; Tex is the standard for mathematical printing, so you should know it, and it is not hard to learn (especially these days when you can Google anything).

Multiple pages must be stapled. (No paper clips, folded corners, torn edges, etc. Origami is wonderful, but not for attaching pages to each other.)

Papers that do not meet these basic formal requirements will not be accepted.

I encourage you to submit assignments electronically to the dropbox provided for this purpose. Alternatively, you may submit a hard copy to my faculty mailbox. (Since this is a Tuesday-Thursday class, convenient due dates may not correspond to class days; in cases when they do, you may also submit your solutions at the beginning of class.) Late assignments will not generally be accepted.

Reports and Presentations: Two reports of 3-5 pages (single-spaced, standard 12-point type) are required; illustrations are very welcome, but do not count for purposes of satisfying the length requirement. Each report should cover a significant topic in the history of mathematics, such as the development of a topic (for example, group theory, modern algebraic geometry, transfinite cardinalities, incompleteness of axiomatic systems, etc.) or the accomplishments of a notable mathematician or school of mathematics. Biographical reports should be sure to include substantive discussion of the mathematical contributions of the subjects, such as major theorems they proved, branches of mathematical study they founded, or novel and original approaches they brought to an area of study, and the importance of those contributions to the history of mathematics. Biographical reports should also include the notable teachers and students of the subjects and discuss the influences they had on each other. Reports focused on a mathematical topic should note those mathematicians who made notable contributions to the field, as well as the times and places these advances occurred.

The two required reports should, collectively, cover mathematics from both earlier and later periods. For purposes of this requirement, consider "early" mathematics (respectively, mathematicians) to be that which was done (respectively,

those who worked) primarily before 1800 and "late" mathematics (respectively, mathematicians) to that which was done (respectively, those who worked) primarily after 1800. (This cut-off is not exact, since the choice of what to consider "modern" is arbitrary. We will have a consultation to approve your topics.) You may fulfill this requirement either by devoting at least one of your reports to following a mathematical topic through its development over both the "early" and "late" periods or by devoting one report to a topic from each period.

Each report should use at least three sources, not all from the Web or from encyclopedias or similar reference collections, with appropriate citations and a bibliography.

A 20-25-minute presentation on one of your reports is required and will be given during the last week of class.

To summarize:

- Length: 3-5 pages (single spaced, standard 12-point type, illustrations not included).
- Substantively discuss the mathematics involved and its importance in the context of mathematical history.
- Discuss the relationships among the protagonists as they affected the mathematical developments.
- Address both the earlier (pre-1800) and later (post-1800) periods of history, either together in a report or separately in the two reports.
- Use at least three sources per report, appropriately cited and listed in a bibliography.
- 20-25-minute presentation based on one of your papers.

Exams: There will be two exams during the term and a final exam. The *mid-term exam* will be given near the middle of the term and cover all material since the beginning of the course. The *end-of-term exam*) will be given near the end of the term and cover all material since the midterm. The final exam will cover all the material in the course.

The exams may include take-home portions or be given entirely as take-homes. In contrast to the homework assignments, you are expected to work on take-home exams alone; no collaboration of any kind is permitted.

Make-up exams will be given only under extraordinary circumstances or in case of serious emergency; prior permission to miss an exam must be obtained from the professor if at all possible.

3. Grading

I do not grade on a "curve". Under no circumstances will your grade directly depend on how how your fellow students do. If you do a good job of learning the material, you will receive a good grade, regardless of how well the other members of the class perform. Don't forget that the reverse is also true: if you do a poor job of learning the material, you will receive a poor grade, regardless of how poorly everyone else does.

The problems on assignments and exams will require proofs or other essay responses. Therefore, I will assign letter (rather than numerical) grades, based on specified objectives and standards. These letter grades will be converted to the standard $0 - 4$ scale, and a weighted average will then be used to compute your final grade for the course.

Letter grades correspond to my judgement of quality as follows:

- A Excellent. The work exhibits mastery of nearly all important ideas, including those which are subtle or difficult, much insight and originality, highly coherent organization and fine expository style. Errors and omissions, if any, are minor.
- B Good. The work exhibits substantial understanding of most important ideas, including some which are subtle or difficult, some insight and originality, coherent organization and correct usage, grammer and spelling. There are some substantive errors or omissions.
- C Fair. The work exhibits basic understanding of many fundamental ideas, although not those which are subtle or difficult, and demonstrates some coherence. The presentation is readable, with at most minor errors of usage, grammer or spelling. There are many substantive errors or omissions.
- D Poor. The work exhibits some understanding of a few fundamental ideas, but not those which are subtle or difficult, and it fails to demonstrate coherence. Usage, grammar and spelling are mostly correct. There are a great many subtantive errors or omissions.
- F No credit. The work exhibits too few of the positive qualities noted above to be worthy of credit.

Each requirement will count toward your final grade as follows (possibly subject to slight modification):

Class Participation:	5%
Problem Sets:	30%
Exams:	$2 \times 15\% = 30\%$
Reports:	$2 \times 5\% = 10\%$
Presentation:	5%
Final Exam:	20%.

Complete honesty on assignments and exams is expected of all students. All sources must be appropriately cited and acknowledged.