MATH 290, Linear Algebra
Fall 2008

Bryan Smith

August 15, 2008

Contents

1   Introduction

For an official description of this course, see MATH 290 Syllabus[4].

The prerequisite for this course is MATH 181, second semester calculus. The focus of this course (Math 290) is very different from the focus of a calculus class. However, there are many examples of linear algebra from calculus as well as physics, chemistry, economics, and computer science. We will take a little time this semester to introduce some of these examples.

Linear algebra is the first "proof-based" course offered in the University of Puget Sound mathematics' curriculum and serves as the gateway course to upper-division mathematics. In addition, it meets the university's "Writing in the Major" requirement. This means there will be at least as much focus on providing **detailed written explanations** of why the mathematical tools of linear algebra work as on linear algebra itself. More details are provided in the Writing Project section below.

1.1   Goals

By the end of the semester, you should have learned to understand linear equations and their solutions, see how vector spaces arise as from generalizing solving systems of linear equations, see the utility of vector spaces in a wide range of topics, read a mathematical text for content and deep understanding (see "How to Study"[5] for an excellent description of how to read mathematics and other efficient ways to study), analyze a given problem to determine which linear algebra tools should be used in its solution, use a variety of strategies to determine and prove a solution of the given problem, and follow accepted mathematical style to present an accurate and carefully written formal proof of your solution.

During a normal class day we will work to achieve these goals by discussing new material, addressing questions that arise from reading the text, and working on homework problems on which there are difficulties.

2   Attendance

Daily attendance is both required and expected. You are also expected to participate fully in class by pre-reading the material to be covered, seeking clarification for unclear points, and engaging in academically honest, mannerly discussions of the topics.

3   Academic Honesty

All graded materials are to be your own work. This includes the reading and writing assignments. You are expected to be familiar with the university's policy on Academic Honesty and will be asked to affirm you abide by it on every assignment and exam.

4   Course Information

4.1   Textbook

The textbook is *A First Course in Linear Algebra, Waldron Edition (Version 2.00),* by Robert A, Beezer, ©2008, and is published by Professor Beezer under the GNU Free Documentation License rather than by a commercial publishing house.

You can purchase a copy from Lulu.com for around $30.00 plus shipping.

Since this is likely to be your first exposure to proof-based mathematics, you should also consider buying one of the many books on "how to do proofs". I recommend "The Nuts and Bolts of Proofs" but one of the other books listed below might appeal to your learning style better. The links point to Amazon.com but you might find better prices elsewhere on the web.

- "The Nuts and Bolts of Proofs", Antonella Cupillari [8]

- "How to Read and do Proofs", Solow [10]

- "Thinking Mathematically", Mason/Burton/Stacey [9]

- "Mathematical Thinking: Problem-Solving and Proofs", West and D'Angelo [12]

- "How to Prove It: A Structured Approach", Velleman [11]

- "Proofs and Fundamentals: A First Course in Abstract Mathematics", Bloch [7]

4.2   Calculator

I require a calculator for this course. It must be able to perform the following matrix operations: row operations, reduced row echelon form, transpose, determinant, and eigenvalues/eigenvectors. I will allow the calculator to be used on examinations but will not allow its use for some problems.

I do not care what calculator you use but I am most familiar with Texas Instrument machines, particularly the TI-86. If you do not have a manual for your calculator, you should be able to find one on the internet – for example at
`http://education.ti.com/us/product/tech/86/guide/86guideus.html`. [6] Be advised that some students have had trouble getting a TI 83 to do all of the necessary computations.

Here is a link to the department's Calculator Policy [3].

4.3   Basic Information

You can find information pertinent to all of my classes at the link below and, once there, information specific to this class by clicking on the Math 290 link.

http://math.ups.edu/ bryans/ [1]

4.3.1   Logistics

Professor Bryan Smith	Thompson 390D	879-3562	bryans[at]ups.edu
Math 290A	Thompson 171	M,T,Th,F	10:00 - 10:50 A.M.
Math 290B	Thompson 283	M,T,Th,F	11:00 - 11:50 A.M.
Office Hours		Mon.,Tue.,Thu.,Fri.	2:00 - 2:50 P.M
		Wednesday	2:30 - 4:00 P.M.

I am also happy to make appointments for other times.

4.4   Examinations

All examinations are scheduled for Thursday. On test weeks there will be a review session the night before from 5:30 until 7:00 P.M. and the exam period will run for 80 minutes (be sure to know when class starts and ends on an examination day).

There will be four (4) 50-minute, in-class examinations. I will drop the lowest score. I do not give make-up examinations except for truly exceptional circumstances. You **should not** expect all examination questions to closely mimic textbook examples or assigned homework problems.

There are copies of old exams on my web site. They might contain typos or even errors. They are offered "as is" for those who might use then as a study aid. But they are **not** part of this semester's course.

Examination One	Thursday	September 18
Examination Two	Thursday	October 16
Examination Three	Thursday	November 13
Examination Four	Thursday	December 4

4.5   Final Examination

The final examinations are scheduled for
    Math 290A   Wednesday, December 17   8:00 - 10:00 AM
    Math 290B   Friday, December 19   noon - 2:00 PM
    The final examination will be comprehensive and cannot be rescheduled so do not plan plane flights (or anything else) that will conflict with it. I may allow you to work longer than the two hours scheduled for the final.

4.6   Writing Projects

In order to meet the Writing in the Major requirement, I will assign two written proofs for each chapter. You are to both find a proof for each and clearly write them up. These will be graded pass/fail for both mathematical content and written presentation. They are due in class on every second Thursday. You may resubmit repeatedly provided: 1) you make a serious effort on each retry and 2) you have not missed a due date for any resubmitted problem. I will not accept late submissions so once you miss a submission date, that problem will be marked as a fail. All work on these proofs is to be your own. That is, there is to be no collaboration either on formulating a proof or in writing it. The only exception to this is any discussion of a problem that you witness **in class**.
    See the grading rubric on the last page of this document for further details pertaining to written mathematics.

4.7   Homework

It is wise to work most, if not all, of the homework problems in the textbook. Although they will not be collected, they should form the basis for much of our in-class discussions – especially on the Additional Content days in the tentative schedule.

4.8   Reading Questions

It is very important that you read the material at least twice. Once before and once after it is discussed in class. It is also important that you read correctly. Mathematics requires that you read **slowly** and with a pencil and paper at hand. (See "How to Study"[5] on the course webpage for more details.)
    There are reading questions at the end of each section of the book. You are to read these **before** we cover that material (see the tentative schedule and email your answers to me by 6:00 AM the morning we discuss that section in class. Note that these will not be accepted late.

- My email address is bryans(at)ups.edu

- The "Subject" line must contain "290" followed by the section's acronym. For example, the first reading assignment should have "290 WILA" as it's subject line.

- Have your full name as the first line of your response.

- Give very brief answers. Do not include computations for numerical questions but do give brief reasons.

- Send only pure text. Do not send attachments, WORD files, or graphics. Do not send your answer in HTML if you can avoid it.

- Mathematical notation is cumbersome in text-only email but don't worry too much about it. I should be able to decipher most reasonable attempts.

4.9   Course Information Updates

If you wish, I will post (and update) a grade report on your current standing in the class on my university web page. You should keep track of your grades on the various assignments and check them against these reports. If there are any discrepancies they should be dealt with immediately.

To have your information posted you need to print your name, the class (MATH 290), and a code on a sheet of paper. Then sign the paper and physically hand it to me. The code is to be a sequence of up to 23 symbols I can type on a keyboard.

4.10 Total Points

Writing Projects	25%
Reading Questions	10%
Examinations	45%
Final Examination	20%

References

[1] Bryan Smith's Homepage
   `http://math.ups.edu/~bryans/`

[2] Math 290A Course Webpage
   `http://math.ups.edu/~bryans/Current/Spring_2007/290Index_Spring2007.html`

[3] Department Calculator Policy
   `http://www.math.ups.edu/info/calcpolicy.pdf`

[4] Department Syllabus for MATH 290
   `http://www.math.ups.edu/~matthews/Syllabi/MA290Syllabus.pdf`

[5] William Rapaport's "How to Study"
   `http://www.cse.buffalo.edu/~rapaport/howtostudy.html`

[6] TI-86 Manual
   `http://education.ti.com/us/product/tech/86/guide/86guideus.html`

[7] "Proofs and Fundamentals: A First Course in Abstract Mathematics", Bloch
   `http://www.amazon.com/exec/obidos/ASIN/0817641114/`

[8] "The Nuts and Bolts of Proofs", Antonella Cupillari
   `http://www.amazon.com/exec/obidos/tg/detail/-/0120885093/`

[9] "Thinking Mathematically", Mason/Burton/Stacey
   `http://www.amazon.com/exec/obidos/ASIN/0201102382/`

[10] "How to Read and Do Proofs", Solow
   `http://www.amazon.com/exec/obidos/ASIN/0471406473/`

[11] "How to Prove It: A Structured Approach", Velleman
   `http://www.amazon.com/exec/obidos/ASIN/0521446635/`

[12] "Mathematical Thinking: Problem-Solving and Proofs", West and D'Angelo
   `http://www.amazon.com/exec/obidos/ASIN/0130144126/`

5   Math 290 Writing Projects   Grading Rubric

Code	Logic and Mathematics
Accept	Arguments are correct, complete and without inappropriate material.
L1	Arguments have one minor error, omission or inappropriate inclusion.
L2	Arguments have two minor errors, omissions or inappropriate inclusions.
L3	Arguments are more seriously flawed.

Code	Use of Terminology and Notation
Accept	All technical terms, concepts and notation are used correctly.
T1	Arguments have one lapse in terminology and notation
T2	There are minor problems with terminology or concepts.
T3	There are major problems with terminology or concepts.

Code	Written Presentation
Accept	Clearly Presented following all other writing guidelines.
W1	Follows almost all of the guidelines with only one or two minor lapses.
W2	Has more lapses in following the guidelines.
W3	Major lapses in the guidelines.

5.1   Writing Guidelines

It is best to think of these writing projects as officially assigned papers in which you completely explain and justify your analyses of the problems. There is to be no collaboration at all when you work these problems and write them up. Your sole outside resources are direct discussions with me or discussions that occur during class.

In addition I expect your papers to be

- Fully documented – specifically:

    1. Any idea obtained during in-class brainstorm sessions is cited in-line.
    2. All textbook results (theorems, propositions, and lemmas) are cited in-line and include the name of the result.
    3. Any use of technology is cited in-line.

- Carefully handwritten in ink or written with a word processor. (I can show you how to use Scientific Notebook in the labs or you can use Mathematica or Microsoft Word. Please check with me before using any other program.)

- Written using complete, accurately punctuated sentences.

- Presented in active voice, the first person plural and with a clear, easy-to-follow expository style.

- Targeted at an audience consisting of students not in this class but with an equivalent mathematical background – say those currently in another section of this course.