MATHEMATICS 2270
Introduction to Linear Algebra
Spring semester 2004

Time: MTWF 8:35–9:25am LCB 121

Instructor: Professor Grant B. Gustafson[1], JWB 113, 581-6879.

Office Hours: JWB 113, MWF 9:55-10:30am and 11:45-12:15. Other times will appear on my door card and on the internet due date page.

Telephone: 581-6879. Please use email whenever possible.

Email and web site: `gustafso@math.utah.edu` `http://www.math.utah.edu/~gustafso/`

Tutoring: The Math Department Tutoring Center is located in LCB, and it is open for free tutoring from 8 a.m. to 8 p.m. on M-Th, and from 8 a.m. to 2 p.m. on Friday. Some, but not all of the math tutors welcome questions from Math 2270 students. To see the times and specialities of various tutors, consult the web address `www.math.utah.edu/ugrad/tutoring.html`.

Texts:

> *Linear Algebra with Applications*, 2nd edition, by Otto Bretcher, Prentice-Hall 2001 (the required text).
>
> *Student Solution Manual*, for Otto Bretcher's text *Linear Algebra with Applications*, 2nd edition.
>
> *WWW documents for 2270*, by GB Gustafson, at web site `www.math.utah.edu/~gustafso`. All are pdf or text documents that can be printed from `Netscape` or `MS explorer` web browsers.

Prerequisites:

Math 1210 and 1220 or the equivalent. This is first-year Calculus, with a very brief introduction to linear differential equations. The old Math courses 111-112-113 of 1997-98 fulfill the requirement. In addition, background is required in planar curves, velocity and acceleration vectors from Physics 2210 or Math 2210, or their equivalent courses.

A passive knowledge of `maple` is assumed. The entire course can be done without `maple`, but all computer code examples are supplied in `maple` only.

Persons without the passive knowledge of `maple` and `unix` may attend one of the *tutorials* on the subject offered during the first two weeks of the term. The instructor for these tutorials is Angie Gardiner, 585-9478, `gardiner@math.utah.edu`. The dates and times are printed on Angie's door MC 155A (building LCB). See also the tutoring web address cited above. Free tutoring is available in the LCB tutoring center 8:00 a.m. to 8:00 p.m. daily except until 6:00pm on Friday, closed weekends and semester holidays.

Course content:

This course is an introduction to linear algebra for mathematics majors and science majors. All chapters of Otto Bretcher's text plus class notes will make up the course material.

[1]Pronunciation: In the phrase *Gust of Wind* change *Wind* to *Sun*

Grading:

Final grades will be based on:

> Textbook problems, call **dailies**, about 132 scores.
>
> The dailies include computer projects.
>
> Written midterm examinations (3).
>
> An in-class 2-hour final examination that counts as two additional midterm scores.

Written In-Class Exams:

There are three (3) midterm exams. Some portion (20 minutes or more) of each midterm is in-class, while the remainder of the exam is done outside of class and submitted separately. The outside work is due at class time on certain dates before the in-class exam. There is a final exam (in-class, 2 hours) as scheduled by the university. The midterm and final exams are graded by G.B. Gustafson.

Hand-written Dailies:

There will be 141 dailies due during the semester, including textbook problems and maple labs. They will be graded by a staff of readers employed by Angie Gardiner.

Textbook problems:

Textbook problems to be submitted for grading are listed on the `gradesheet` for the course. Tentative dates are set for each problem set. Visit the web site for extra copies. The actual due dates for problems appear only on the web site and they are dynamically updated to reflect the reality of what was discussed in class. Generally, problems are submitted shortly after they are discussed in class, and hopefully on the date printed on the gradesheet.

All students must complete each textbook problem and submit their work in their own handwriting. Collaboration is permitted and encouraged on textbook problems in teams of not more than 2. You must submit separate a handwritten report with citation to the partner.

There are certain **rules** for writing up the textbook problems and the take-home portion of a midterm exam. A full accounting of the *format rules* contributed by Utah students appears on the internet course page as *format for submitted work*. Kindly apply the ideas therein to your written work, both textbook problems and take-home midterm exam problems.

Take-home exam problems:

A portion of each of the three midterms is a take-home exam, to be completed and submitted by the due date published on the web site. The format rules apply strictly: what you submit is considered to be your very best work. It will be judged accordingly against the submissions of others.

Collaboration on take-home exam problems is not sanctioned. Tutors and lab assistants may answer questions, but they will not work the problems for you or certify correctness of your solution. Duplicate solutions will be considered a deliberate act of plagiarism.

In-class midterm exam problems:

A midterm sample in-class exam is supplied a few days before the in-class exam. Exam problems are modeled after those already solved on the take-home portion of the exam.

Books, tables, notes and calculators are not allowed on exam day.

An in-class Midterm exam has different presentation rules, and none of the textbook problem rules apply in this case. Basically, the in-class exam is a first draft.

Computer projects:

There will be one to three computer projects assigned during the semester, related to the classroom material. They will be written by hand and use the software package `maple`. There is a Math Department Computer Lab in building LCB at which registered students automatically own accounts. Drop-in tutoring in the computer lab in building LCB starts the second week of the semester.

Final exam:

Two hours are reserved for this written exam. As published by the university, the final exam for the 8:35 class is Wednesday May 5, 8-10am in the regular classroom.

The final exam is comprehensive. About one hour of the exam covers the last three weeks of the course. The remaining time covers all topics that appeared on the previous three midterm exams.

No notes, calculators, tables, books or aids of any kind are allowed on the final exam. Please bring pencils and eraser. Paper will be supplied.

Withdrawal:

It is the Math Department policy, and mine as well, to grant any withdrawal request until the University deadline. This promise also means that such a withdrawal requires no explanation. Withdrawals are always initiated by the registered student. All paperwork is the duty of the student. My job is the signature.

ADA statement:

The American with Disabilities Act requires that reasonable accommodations be provided for students with physical, sensory, cognitive, systemic, learning, and psychiatric disabilities. Please contact me at the beginning of the semester to discuss accommodation (113 JWB or 581-6879), which is to say, accommodation shall be made.

Grading Scale:

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A  = 95-100, A- = 92-94, B+ = 88-91, B  = 84-87,
B- = 80-83,  C+ = 75-79, C  = 65-74, C- = 60-64
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This scale is determined from 40% passing use GPA increments. It is used for grading and for final letter grade reporting. This scale is for internal use only.

Grading Details:

Rite of passage: A passing grade in the course requires at least 80 of the 141 dailies (includes computer projects) to be submitted. A grade of E is assigned if less than 80 Dailies are submitted. The scores on the 80 dailies are expected to be passing at C level or higher.

The right of passage is absolute, similar to the European system, which requires a body of work to be presented before written and oral final exams are taken. For example, the Czech *vypočet* is a requirement to show a body of completed work as the entrance requirement to administration of written and oral final exams.

Final grade: It will be determined as follows:

$$\text{Final Grade} = \frac{30}{100}(\text{Dailies Average}) + \frac{70}{100}(\text{Midterm+Final Average}).$$

An example: the Dailies Average for 132 textbook problems and maple labs is 91% and the Exam Average of the three midterms and the final exam is 86%. The final grade is $0.3(91) + 0.7(86) = 87.5\%$, which by the scale above is a B. While 87.5 rounds to 88, a $B+$, the deciding factor is really the exam average of 86, which is squarely a B. The final grade is B. If the dailies average was 93 or higher, then the final grade would be 88.1 or higher for a B+.

Purpose of the textbook problems. The *purpose* of the problems is to practice doing mathematics, that is, to write out in detail the solutions to problems. A textbook problem is either a proof or else an engineering–style "crank" problem. The process:

- **Understand the problem**. Understanding usually involves reading the *problem notes* and the textbook. Answers are usually not provided. You may get an outline of the solution, to increase the probability that the project gets completed on schedule. Problems are discussed in class in great detail.
- **Background reading**. To solve a problem, a second opinion of the theory and method is essential. It might be that you can flesh it out of your book's examples, the college algebra text, the calculus text or some alternate mathematics book. No matter, go to a source that works for you. This is *reading* and not a tutorial.
- **Scratch Paper Write–up**. The initial creation of a solution is the essence of the learning process. Everyone learns by repetition, and here is where you do it. Use a pencil and a big eraser, lots of paper, and flesh out a first draft at full speed. This is not the paper you turn in.
- **Final Copy**. The final copy of the solution uses the scratch paper draft as raw material to *present* the details of the solution. As such, it is more than a collection of formulas on paper. There is no strict requirement, except that *neatness* and *completeness* are a must.
- **Final Copy Format**. The most successful format to date was invented by several engineering mathematics students over the years 1990–2004. This format is described in some detail below and also in the internet document *format for submitted work*.

Some Format Suggestions

1. Use engineering paper or plain white paper. Lined notebook paper and graph paper are not acceptable, because they cause inappropriate vertical white space for mathematics.
2. Reports are hand-written. They start with a problem statement followed by the book's answer or by a final answer summary. Supporting material appears at the end, like a tax return.
3. Mathematical notation is on the left, text on the right, about a 60% to 40% ratio. One equal sign per line. Justify equations left or align on the equal signs.
4. Text is left-justified on the right side. It includes explanations, references by keyword or page number, statements and definitions, references to delayed details (long calculations, graphics, answer checks).

5. Any of rules 1-4 can be broken.

6. Every report has an answer check. For odd-numbered problems it is usual to see "*the answer matches the textbook*." For even-numbered problems, a full answer check is expected.

Plagiarism is defined as

> the unauthorized use of language and thoughts of another and the representation of them as one's own.

Textbook problems have **answers** and **solutions** published by Otto Bretcher. He *owns* the work. You are authorized to cite *answers* without reference, in the course of doing a problem. To copy Otto's *solution* from the solution manual and represent it as your own work is plagiarism. A blatant violation is the submission of a solution no different than what is found in the solution manual, or a problem statement followed by no work or explanation, just the author's answer. Such circumstances are rewarded with zero credit; forfeited are opportunities to redo the problem for credit.

Maple computer labs are plagiarized by xeroxing an identical copy of a maple lab without citation. You are allowed to work in groups of two, but you must cite the second author to receive credit. That is, John and Jack can have identical maple printouts provided they cite each other. Groups of three with identical maple computer labs are considered plagiarism, even if citations are made. The safest plan is to write your own lab using suggestions from others. Such singular efforts do not require citation.

Cooperative efforts are allowed and encouraged in groups of two. Where appropriate, **citations** are required for those who help you, with the exception of mathematics staff and tutoring staff. There is no penalty for getting help from others – it is encouraged. Please cite those who help, because it is an honorable gift to those who spend time on your behalf.

Presentation is expected to improve throughout the 14 weeks of the course. You are not expected to be an expert in the first week. Correctness of answers will be checked. The class notes might contain answers plus a solution outline. Your job is to *improve* upon the initial start into the solution. Add the particulars, make comments, chase down the details from algebra and calculus. Writing up the solution identifies the hurdles and it forces a review of background material.

References are required on the first occurrence. After that, omit the citation. It is appropriate, however, to refer to the previous assignment on which the citations originated. A statement like "References parallel Exercises 1-5" is enough.

Due dates. All due dates are updated dynamically, at `www.math.utah.edu/~gustafso/`. Consult this resource often. To repeat: the due dates are not given in class! Sometimes, email communication about due dates and exams will be made from the registrar's list. If your campus information data is incorrect, then please visit the campus WWW system to update the information.

Makeups and Late Work. Due to the number of dailies being collected, work is considered late and therefore unacceptable when two (2) days have elapsed since collection in class. The lowest nine (9) dailies are dropped from consideration in order to eliminate makeups. If more than six textbook problems have zero scores, then please call 581–6879 or email `gustafso@math.utah.edu` and discuss the situation and options for getting a passing grade in the course.

Missed Deadlines. There is an absolute deadline for each collection. After the stack is sent to the grading assistant, all late work received henceforth earns a zero.

Iterations and Redos. You may be asked to iterate your work from Chapter one in order to straighten out bugs in the presentation or details. Kindly mark your work **REDO**. Submit whatever is requested, but no more, in order to keep the paper trail brief. The deadline for a **redo** is 5 days from the date returned. Such requests end after chapter one has been returned.

Missed Midterm Exams. Missing an in-class exam is a disaster and therefore there will be a scheme to makeup one exam. If you miss two exams, then please equip yourself with reasons in writing and see me in JWB 113, write email or call 581-6879. Likely, the scheme is 50-minute midterm exam 4, to be given in the last week of classes. The content and level of midterm exam 4 parallels a final exam.

Spring 2004 Tentative Daily Schedule

Week 1, Jan 12,13,14,16	Section 1.1, 1.2. Submit gradesheet. Begin first maple lab.
Week 2, Jan 20,21,23	Sections 1.3,2.1,2.2. Holiday Mon Jan 19.
Week 3, Jan 26,27,28,30	Sections 2.3,2.4.
Week 4, Feb 2,3,4,6	Sections 3.1,3.2,3.3.
Week 5, Feb 9,10,11,13	Sections 3.4,4.1. Exam 1 Feb 10.
Week 6, Feb 17,18,20	Sections 4.2,4.3. Holiday Feb 16.
Week 7, Feb 23,24,25,27.	Sections 5.1,5.2,5.3.
Week 8, Mar 1,2,3,5	Sections 5.4,5.5.
Week 9, Mar 8,9,10,12	Sections 6.1,6.2. Exam 2 Mar 9. Spring break Mar 13-21.
Week 10, Mar 22,23,24,26	Sections 6.3,7.1,7.2.
Week 11, Mar 29,30,31, Apr 2	Sections 7.3,7.4,7.5.
Week 12, Apr 5,6,7,9	Sections 7.6,8.1. Exam 3 Apr 7.
Week 13, Apr 12,13,14,16	Sections 8.2,8.3.
Week 14, Apr 19,20,21,23	Section 9.1,9.2,9.3.
Week 15, Apr 26,27,28	Final Exam review. Lectures end Apr 28.
Week 16, Apr 30 to May 6	Final exam period. Gradesheet due in 113jwb. Final exam for the 8:35 class is 8-10am on Wed May 5.