MATH 2700.006. Linear Algebra and Vector Geometry.

Fall 2014, MWF 9 to 9:50, SAGE 354.

Textbook as required by the department (but you may not need). David C. Lay, Linear algebra and its applications. 3rd edition, Addison-Wesley, Boston, 2006. ISBN 0-321-28713-4. We should do all the chapters in the book but in a different way. See the syllabus before buying the book. There are useful online courses and free textbooks on linear algebra which you may want to look as: the best is on mitopencourseware. A reasonable book (and it's free) is the book called "Linear Algebra Done Wrong" on the Brown University website.

Estimated cost of taking this course, in addition to UNT tuition and course fees. The list price of the textbook is around $180. You may be able to avoid buying the book. You will find it extremely helpful to have a scientific graphing calculator. I will not be using a grader (see below) and so you may have a refund of your "grading fee".

Final and test dates. There are two tests during the semester, tentatively on Friday, September 19, Friday October 24, and Friday November 21. According to the UNT website, the final is on Wednesday, December 10, 8 to 10am. in the usual class room.

Grades and exams. Your final grade is determined by three tests given during the semester (25% each) and the final (25%). I will hand out review sheets before each test and the final. The letter grade will be given strictly according to the recommended university standards: D = at least 60%, C = at least 70%, B = at least 80%, and A = at least 90%. Acceptable excuses for missing a test or the final are: illness or injury requiring professional medical attention, deaths of an immediate family member (genealogical distance 2), or injury accidents. You may be asked to furnish documentary proof. Alternate tests will be different from the regular test and may be graded using a different procedure. Requests for alternate tests must be made *in person* during class or office hours *no later than one week after the regular test day.*

Your tests (but not the final) will be returned to you, usually the first class day following the test, except when it is not. You should be in class to pick up your test. No responsibility will be taken for tests which are not picked up within two weeks.

Homework. Homework will be assigned, once a week, almost always due on Wednesday. You are mature students and will take responsibility for doing them. I will hand out solutions and you should check them against your work. See the individual schedules.

Attendance. You are expected to attend all scheduled classes for the full class period, including the first day! Attendance will be checked by by discreet and indiscreet electronic means at a random time during the class period. Attendance is a necessary condition for a passing grade. If you miss six or more class periods (20%), then you may receive a failing grade independently of how you are doing on the tests and final. There is no substitute for attending class, taking notes, doing the homework, and studying the material consistently during the semester.

Terminology and notation. Linear algebra is an applied subject and people have used different notation and terminology. So, although I will use standard terminology and inform you of different usage, on the test and final, a word means whatever I define it to mean in class!

Prerequisites and code of conduct. The prerequisite course is MATH 1720, Second semester calculus. If in doubt, talk to me.

You may be dropped administratively at any time if you do not have the prerequisites. It is your responsibility to check that you have taken the prerequisite course. Having a prerequisite course means that you have *current* knowledge of the material covered in that course as stated in the official syllabus regardless of what your instructor for that course actually covered.

I expect you to behave in accordance with the student code of conduct. There will be **zero** tolerance of violations of this code: this particularly applies to cheating during tests and the final.

I also expect you to behave with courtesy and consideration towards your fellow students (and to me), particularly during class period. This is a large section and if you indulge in actions which disturb other students, you will be removed from the room at my discretion. All phones and other non-approved electronic devices must be turned OFF during class time and in my office when you consult me during my office hours.

Other matters. All university policies will apply to this course. For requests to accommodate a certified disability, follow the instructions given by the Office for Disability Accommodation (ODA). Your request must be delivered to me in person during the first three scheduled class periods and a signed receipt must be obtained from me for any request to be valid.

Important note about schedules, review sheets, and other handouts.

Schedules are given out every week. The schedules are intended to give you useful information. Handouts, such as review sheets, will also be given out. Information on

schedules or handouts might be changed and errors will be corrected; these amendments will be announced during class. You are responsible for keeping track of these amendments, as well as making sure you get all the schedules and other handouts.

Fine print. There are **no** verbal agreements in this course. If you think that I promise you something, be sure to get it from me in writing! This handout is intended as an general guide to the policies pertaining to the administration of this course. This handout does not replace or supercede any official university document.

Instructor. Joseph Kung. GAB 471C. Office hours: Mondays/Wednesdays 10 to 10:50, 1:30 to 3:00. Other times by appointment.

e-mail: kung@unt.edu [Expect some delay and possible computer problems when using email. Be sure to put MATH 2700 in the subject line. I reserve the right not to respond to ambiguous or abbreviated text messages. All messages to me must be in normal English. Email without this may be put into a SPAM file and unread.]

Phone 940-565-4084.

Syllabus.

This is an introductory course on linear algebra. There are at least three approaches to linear algebra: the theoretical or axiomatic approach, involving proofs, the functional analysis approach, involving real functions and linear operators, and the matrix or numerical approach, involving actual explicit computations. Because this course serves a diversity of students, ALL THREE approaches need to be covered. It is impossible to follow the department textbook rigidly and achieve these aims. We will focus on the ideas and algorithms rather than any explciit material. If you want a course that follows the textbook rigidly, there are other sections of this course. I teach to the serious and committed student and go at the pace of the top 25%.

The textbook may or may not be useful. A useful free resource can be found on the website MIT OpenCourseware 18.06 Linear Algebra. Just google MIT 18.06 opencourseware. 18.06 is a freshman linear algebra course taught at MIT by Gil Strang. This course covers linear algebra (in all its aspects) in a fast-paced but accessible way. We will do much the same stuff, in more or less the same order, with somewhat less detail and omitting some applications. Mathematics is mathematics: there are not "easier" versions. What is done at MIT is universal. The MIT website contains videos of lectures, transcripts of lectures, etc. These may replace the textbook.

Attendance is necessary and required. See the attendance policy stated earlier. The subject is much easier to "get" if you have someone show you the ideas and calculations informally and you can ask questions. Be aware that certain topics may seem deceptively simple. Thinking that you know how to do something and knowing how to do something are NOT the same thing; knowing the difference is part of becoming a "professional".

Typographical errors, especially on dates, may occur in the syllabus. They will be corrected in class. Topics for each week may change depending on how the material comes across to you and we may go faster and cover more topics!

A tentative syllabus

Week 1 (August 25) Solving linear equations, matrices, matrix multiplication, Linear transformations, LU-decomposition

Week 2 (September 1) Real n-dimensional space, column and null space of a matrix

Week 3 (September 8) More on subspaces, solving $Ax = 0$ and $Ax = b$, pivoting, row and column reduction, inverse matrices.

Week 4 (September 15) Application to Markov chains. Review. First test: Friday September 19.

Week 5 (September 22) Independence, basis, dimension. The three fundamental subspaces (there's a fourth, but we won't emphasize the fourth subspace.)

Week 6 (September 29) Spaces of polynomials, linear operators, differential operators on subspaces of polynomials, subspaces of polynomials, inner products, projecting onto subspaces.

Week 7 (October 6) Determinants, signed volumes.

Week 8 (October 13) Cramer's rule, inverse matrices revisited. Eigenvalues and eigenvectors

Week 9 (October 20) More eigenvalues and eigenvectors. Review. Second text: Friday, October 25.

Week 10 (October 27) Symmetric matrices. Diagonalizing a matrix.

Week 11 (November 3) Powers of matrices. Instability of linear algebra computations illustrated.

Week 12 (November 10) Powers of matrices, complex matrices and rotations

Week 13 (November 17) Singular value decomposition, orthogonality, Gram-Schmidt process, least-squares approximation.

Week 14 (November 24) The predator-prey model applied to humans and turkeys.

Week 14 (December 1) More least squares. Summing up. (The provost wants me to give the equivalent of a TED talk; following Galileo and the tradition of the *Accademia Lincei*, I will give a cat's eye view of the subject.) Review for final.

Final. Wednesday, December 10. 8 to 10 am. Usual classroom. Please confirm against the UNT final exam schedule.