Department of Mathematics — Central Washington University

Math 265	Linear Algebra	Fall, 2007

Professor: Dr S.P. Glasby

Course Information

Office:	Rm 119, Bouillon Hall.
Office Hrs:	At times outside office, and by appointment.
URL:	`http://www.cwu.edu/~glasbys/`
Lectures:	MTuThF 10:00 p.m., BU 102.
Text:	S. J. Leon, Linear Algebra with Applications, 7th ed., Prentice Hall, 2006.
Assessment:	Test 1 (30%); Test 2 (30%); Final Exam (40%).
Dates:	T1: Thu Oct 16; T2: Thu Nov 8; E: Fri Dec 4??, 8–10 a.m.??
Safari:	`http://portal.cwu.edu/` for exam time, and final grades

Math 265 is a first course in Linear Algebra (Math 365 is a second course). Over 75% of all mathematical problems encountered in scientific or industrial applications involve solving a system of linear equations. Linear systems arise in applications to areas such as business, demography, ecology, electronics, economics, engineering, genetics, mathematics, physics, and sociology. Linear algebra involves much more than solving systems of linear equations, it also involves abstract and geometric thinking. You will have to use analogies, and learn to think geometrically in more than 3 dimensions. Linear algebra is commonly the first course that a student encounters that requires abstract thought. For this reason, students all over the world struggle when they first meet linear algebra. If you can not devote at least 8 *productive* hours of work per week to this course, then I recommend you take this course later when you can devote the necessary time and effort.

Calculators and computers can be very useful as an aid to computation, for checking hand computations, and as a laboratory for quickly exploring new ideas. I encourage the intelligent use of calculators and computers. My discussions about calculator usage will be confined to the TI83 Plus. You will likely need to improve the accuracy and speed of your arithmetic: calculators are not allowed on tests and the final exam. I have collected useful links on my homepage: go to `http://www.cwu.edu/~glasbys/` and follow the `teaching` link. In particular, there exist links for practising arithmetic and testing algebraic skills.

We shall cover chapters 1, 2, 3 (chapters 5, 6, 7 are covered in Math 365). I should stress though that the lecture notes, not the textbook, form the body of examinable material. I strongly encourage you to read the relevant parts of the textbook *before* attending lectures, review your lecture notes *after* each lecture, and do all the assigned problems! The way to become a good violin player is to practice. To become good at this course (and hence pass) you must practice. You will learn much more doing the exercises yourself than watching an expert solve them for you!

If you are unable to attend a lecture, you should get a copy of the notes from a classmate *who takes good notes*. Consider forming your own study groups: you can learn a lot by explaining solutions to a friend, and by hearing solutions.

After each test I will post adjacent to my office a list of scores and approximate grades, so you can determine your relative position in the class. You should double-check the time of the final exam by using Safari. The exam will be in our assigned classroom.

Students requiring special accommodation, because of a physical or mental disability, should see me in the first week of the course. Also, if you are quite sick or suffer a notable hardship, then please let me know promptly. Claims of lengthy hardship that are disclosed the day before the final exam receive less sympathy. Although the Registrar will notify you of your final grades, you can find out your (unofficial) grades earlier by using Safari.

I plan to make each **Tuesday** a **problem-solving** class. Please bring your textbook on these days. A brief description of the course content, and the approximate number of lectures spent on each topic is: solving systems of linear equations (4), matrix algebra and elementary matrices (4), determinants with applications to areas/volumes and computing inverses (5), vector spaces, subspaces, and dimension (7), the matrix of a linear transformation and change of basis (3). The course outcomes are: (i) that students learn to think abstractly, laterally, logically and critically, and (ii) that (passing) students have a reasonable mastery of the concepts underlying the above topics.

Math 265 Homework Problems

Below is a list of homework problems from the textbook, S. J. Leon, Linear algebra with applications, 7th ed., 2006. You should solve *all* homework problems before Tuesday, and importantly you should write out your solutions neatly using correct notation, correct spelling, and grammatically correct English sentences. I shall deduct points on exams for poor setting out, especially for omitting brackets and equal signs. On problem-solving days you should bring your textbook, your worked solutions, and your questions. The chapter tests, abbreviated CT below, are helpful to test your knowledge before an exam.

§1.1, p.11 1cd, 2cd, 3bd, 5c, 6e, 10
§1.2, p.25 1, 2, 3, 5efi, 10, 13, 17, 20*
§1.3, p.57 1abefg*h*, 2a–f, 4, 8, 15, **20**, 22, 23
§1.4, p.69 1, 2, 3, 4b, 6, 9ab(i), 10, 11
§1.5, p.79 1abc, 11
CT1, p.87 1–9, 10*
§2.1, p.96 1, 3bcdg, 4abc, 11
§2.2, p.103 1, 2a, 3ac, 4, 5, 6, 7, 9, 12, Q1 below
§2.3, p.109 1, Q2 below
CT2A, p.113 1, 2, 3, 5–10
§3.1, p.121 4, 8, 9, 11, 15, 16
§3.2, p.131 1bce, 2abc, 4ab, 8, 9a, 10ae, 11, 12
§3.3, p.144 1, 2, 4, 5, 11
§3.4, p.150 1, 2, 3, 4, 5, 10, 16
§3.5, p.161 1, 2, 3, 5, Q3
CT3A, p.172 1–8

Q1 Compute the determinant $\begin{vmatrix} 1 & x & x^2 \\ 1 & y & y^2 \\ 1 & z & z^2 \end{vmatrix}$ by using row operations, and taking out factors of $y - x$ and $z - x$. Hence determine when the determinant is nonzero.

Q2 Compute the inverse of $A = \begin{bmatrix} 1 & 1 & 1 \\ 1 & y & y^2 \\ 1 & z & z^2 \end{bmatrix}$. [Hint: $\det(A) = (y-1)(z-1)(z-y)$.]

Q3 Let $U = [\mathbf{u}_1, \mathbf{u}_2]$ be the (ordered) basis for $\mathbb{R}^2$ obtained by rotating the standard basis $E = [\mathbf{e}_1, \mathbf{e}_2]$ by θ radians counterclockwise about the origin.
(i) Show that $\mathbf{u}_1 = \begin{bmatrix} \cos\theta \\ \sin\theta \end{bmatrix}$ and $\mathbf{u}_2 = \begin{bmatrix} -\sin\theta \\ \cos\theta \end{bmatrix}$.
(ii) Find the change of coordinate matrix $C_{U,E}$ from the basis E to the basis U.