Math 330 Linear Alg.

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    MWF 1:00-1:50PM in DMS 238 and through Zoom by appointment

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Upon completion of this course, students will be able to

- Solve linear systems using Gaussian elimination.
- Minimize least squares by Gram-Schmidt orthogonalization.
- Find LU, QR and $U\Sigma V^T$ matrix factorizations.

Note that Gaussian elimination provides LU factorization

Gram-Schmidt orthogonalization leads to QR factorization

That other matrix factorization is related to eigenvalues and eigenvectors.

Important: There are three web pages related to this course.

1 The WebCampus webpage will contain the links to turn in the scanned written homework, the Zoom meeting links and used to communicate via electronic messages.

2 There is a link to https://fractal.math.unr.edu/~ejolson/330-23/ from the homepage on WebCampus which is where I will post my announcements about exams, homework assignments and lecture notes (like this one).

3 The textbook is available from the Peason MyLab website. There will also be online homework that needs to be done there.

We will follow the textbook starting from Chapter 1 and ending in Chapter 7. Some sections will be skipped--especially applications that you'll likely see in the engineering, science and economics classes for which this course is required. Some topics introduced in early chapters will be returned to in subsequent chapters and elaborated on.

Teaching a little bit of one topic, then doing something else, and then returning to the first topic again is called the spiral method of teaching mathematics. Although it's like going in circles, this allows each topic time to sink in before it is further developed.

We will do our best to follow the order of presentation in the text.

Let's look at the book and see what's coming up:

Chapter 2 Matrix Algebra 97

Note how sections from chapter 1 are revisited in chapter 2.

Chapter 3 Determinants 171

short, because determinants are mostly used for theory...

This chapter could be much longer, but we do only what is necessary to develop techniques for finding eigenvalues later in chapter 5 later.

Chapter 4 Vector Spaces 201

Most of Chapter 4 is an elaboration on what was already introduced in Chapters 1 and 2.

Chapter 5 Eigenvalues and Eigenvectors 273

Skip these

We don't have time for many applications, but if there is one you particularly want to learn about, please send me a note on WebCampus saying so. I'll try to add it to the course.

Chapter 6 Orthogonality and Least Squares 349

This section was the first chapter in the linear algebra book by Boyd and Vandenberghe. It focuses on the second learning objective--optimization, Gram-Schmidt and the QR factorization.

Note that the first learning objective--Gaussian Elimination--was already covered in sections 1.5, 2.2 and 2.5.

Chapter 7 Symmetric Matrices and Quadratic Forms 417

We won't cover very much from Chapter 7 but just enough to do the singular value decomposition. This is the last matrix factorization and surprisingly important in applications involving digital filtering and compression. For example, this factorization is related to the proper orthogonal decomposition which is used in machine learning and data mining.

On Wednesday we will start chapter 1.

We will not spend too much time of chapter 1, because those topics will be reviewed again in chapter 2 and 4.