#### **Syllabus**

Course: Math 340L Matrices and Matrix Calculations Time: T-TH 9:30-11:00 in WAG 214 Instructor: A. K. Cline Office: GDH 5.808 Office Hours: Tu 11-12, W, 11-12, F 1-2, and by appointment Web Site: http://www.cs.utexas.edu/users/cline/M340L/ Email: cline@cs.utexas.edu

Assistant: Jillian Fisher Office: TBD Office Hours: TBD Email: <u>fisherjillian@ymail.com</u>

**Prerequisite**: M408C or M408K or M408N with a grade of C- or better. Note: A student cannot get credit for both M340L and M341.

**Text:** Linear Algebra and its Applications, 4<sup>th</sup> or 5<sup>th</sup> ed., by David C. Lay. You can get this at Amazon through <u>http://www.amazon.com/Linear-Algebra-Its-Applications-</u> ebook/dp/B005HAWLNW/ref=sr 1 1?s=books&ie=UTF8&gid=1375117343&sr=1-1

**Purpose:** Computer science students view linear algebra very differently from other science and engineering students. They engage the material more on an algorithmic level. More so than other students, they have a need to learn higher level abstractions and theoretical concepts of proof (though not at the level of a mathematics student). They also need to cover some linear algebra topics to a greater extent and de-emphasize others.

Grading: Exam 1: 20% Exam 2: 20% Final Exam: 45% Homework: 15%

**Special Tutoring Session:** Every Monday evening from 6 to 8 PM, there will be a session in GDC 6.302 to answer questions. The questions may arise from homework assignments or otherwise. Please realize this will not be a repeat of lectures. The tutors will be present to respond to questions.

### **Topics**:

- 1. Introduction to Vectors
  - 1.1. Vectors and Linear Combinations
  - 1.2. Lengths and Dot Products
  - 1.3. Matrices

# 2. Solving Linear Equations

- 2.1. Vectors and Linear Equations
- 2.2. The Idea of Elimination
- 2.3. Elimination Using Matrices
- 2.4. Rules for Matrix Operations
- 2.5. Inverse Matrices
- 2.6. Elimination = Factorization: A = LU
- 2.7. Transposes and Permutations
- 3. Vector Spaces and Subspaces
  - 3.1. Spaces of Vectors
  - 3.2. The Nullspace of A: Solving Ax = 0
  - 3.3. The Rank and the Row Reduced Form
  - 3.4. The Complete Solution to Ax = b
  - 3.5. Independence, Basis and Dimension
  - 3.6. Dimensions of the Four Subspaces
- 4. Orthogonality
  - 4.1. Orthogonality of the Four Subspaces
  - 4.2. Projections
  - 4.3. Least Squares Approximations
  - 4.4. Orthogonal Bases and Gram-Schmidt
- 5. Determinants
  - 5.1. The Properties of Determinants
  - 5.2. The Area Property
- 6. Eigenvalues and Eigenvectors
  - 6.1. Introduction to Eigenvalues
  - 6.2. Diagonalizing a Matrix
  - 6.3. Similar Matrices
  - 6.4. Applications
- 7. Linear Transformations
  - 7.1. The Idea of a Linear Transformation
  - 7.2. The Matrix of a Linear Transformation
  - 7.3. Examples on R<sup>n</sup> :rotations, projections, shears, and reflections

# Comments:

1. Good homework cannot make up for poor exams nor good exams for poor homework. To do well in the course grade, students must have good homework and exams.

2. There will be approximately three sets of homework problems assigned each two weeks. These will be due at the **beginning** of the following class. Solutions for each problem set will be distributed electronically.

3. An excellent summary of expectations is found at http://www.cs.utexas.edu/users/ear/CodeOfConduct.html

#### **Homework Specifications**

1. Your solutions must be legible. If your writing is not legible, use a word processor.

2. Every sentence - even those using mathematical notation - must be readable. There must be clear subjects and verbs - not just random phrases.

3. Criticize your own solutions. You should be learning not only how to create solutions but how to recognize correct ones. If you wonder about having too much or too little detail, err always on the side of too much detail.

4. If you realize that your solution has gaps or errors, admit that. Put comments about such omissions or possible errors in boxes.

5. Test your computations whenever possible.