Math 510 Fall 2016
Syllabus, Course Information, and Policies

Course web-site: http://orion.math.iastate.edu/lhogben/math510.html
Blackboard is used for grades
Text: Fuzhen Zhang, Matrix Theory: Basic Results and Techniques, 2nd ed.
Lectures: MWF 9-9:50 AM in Carver 274
Discussion/review session: M 3:10-4:40 PM, room will be posted on website

Instructor: Leslie Hogben
e-mail: hogben@iastate.edu, hogben@aimath.org
Email to hogben@aimath.org may receive a faster response if I am traveling, but anything confidential should be sent only to hogben@iastate.edu.
Personal web-site: http://orion.math.iastate.edu/lhogben/homepage.html
Telephone: 294-8168 (message may not be received; e-mail is better)
Office: 488 Carver
Office Hours: posted (and updated) on the website, tentatively MWF 10-10:50 AM (beginning Aug. 29 and ending Dec. 9; final week OH schedule is different). Also by appointment or whenever you find me (please knock even if door is closed- if I can’t meet at that time, we can find another time).

TA Xingyu Tong
e-mail: tongx@iastate.edu
Office: 447 Carver
Office Hours: TBD, will be posted on website

Course Goals (AKA Learning Outcomes) Students will be able to use advanced linear algebra in their research and be prepared the Linear Algebra Qualifying Examination. Math 510 is the core graduate linear algebra course.

Course Content (AKA Linear Algebra Qualifying Examination Syllabus, AKA Learning Objectives, when prefaced by ‘Students will master the following content’):
Vector spaces: subspaces, basis, coordinate vectors, change of basis.
Matrix arithmetic for partitioned matrices.
Linear transformations: matrix of a transformation, kernel, range, rank, Dimension Theorem, linear functionals, dual basis.
Determinants and their properties.
Inner products: Cauchy-Schwartz inequality, orthonormality, Gram-Schmidt, projection, Hermitian adjoint of a matrix and transformation.
Eigenvalues, eigenvectors, characteristic polynomial, minimal polynomial, Cayley-Hamilton Theorem, algebraic and geometric multiplicity, diagonalization.
Unitary matrices and transformations, normal matrices and transformations, unitary diagonalization of normal matrices, Spectral Theorem, Schur's Unitary Triangularization Theorem. … continued on next page
Canonical forms: Jordan canonical form, rational canonical form, invariant factors, elementary divisors, Primary Decomposition Theorem.
Hermitian matrices, Rayleigh-Ritz Theorem, variational characterization of eigenvalues (min-max) and applications, positive-definite matrices.
Material to be covered: all or parts of Chapters 1, 2, 3, 6, 7, 8, 9 in Fuzhen Zhang, Matrix Theory: Basic Results and Techniques, 2nd ed. and additional material
More detailed information is updated on the website.

Prerequisites: Math 317; or Math 407; or Math 207 and (Math 301 or 414)

Course format: lecture

Assessment Your grade will be based on:
1 one hour exam 50 points
1 take-home examination 30 points (computation of canonical forms using computer)
final examination 100 points
graded homework 50 points (5 assignments, 10 points each)
See web-site for dates.

Your grade will not be worse than that obtained from an 90, 80, 70, 60 scale applied to the above total, and may be better. There is no curve in the traditional sense, in that you are not competing against each other, but against an objective standard- the goal is to have everyone succeed. Note that I interpret a grade of A to mean I think you are prepared to pass the linear algebra qualifier and a grade of B to mean that you have satisfactorily completed the PhD core course requirement in linear algebra.

Discussion Homework The discussion homework assigned in each class and listed on the web-site will not be graded; it is intended to help you learn the material and prepare for the examinations. There will be five graded homework assignments, clearly identified.

Additional Help The lectures do not review most undergraduate material nor is homework discussed, but additional help is offered through the discussion/review sessions led by the TA. Undergraduate material will be reviewed at the beginning of the semester during discussion/review, and discussion/review sessions are the place to ask about discussion homework.

Collaboration and outside resources You are encouraged to work together and/or utilize the library or internet, using whatever method helps you learn, except that the following restrictions apply to graded work:
- You are not permitted to use outside sources (books, internet, people not involved in this course) for any graded work.
- You should not discuss your take-home test with anyone except me (Leslie).
- You may discuss graded homework assignments with other students enrolled in this class and/or with me (Leslie) but should not take any notes from these discussions and should not show your written solution to anyone prior to the final due date. You must write up your own work and we should not be able to determine with whom you discussed it when reading it.
Due dates:
Graded homework and the take-home exam have two due dates. The due date (first date) is the date it is actually due, and it is due in class by 9A (before the lecture starts). The second date is the last date it will be accepted and it must be received by me (Leslie) by 8:50AM on the given date (to submit on last day bring it to my office). Assignments will not be accepted in class on last day since by the time I get to class it is too late. Dates will be announced on the website at least 1 week before the due date. Assignments may be submitted in advance in person, by sliding under the door of 488, or electronically before 8A on last day (I send e-receipts- if you do not get one inquire- do not assume it was received).

Late homework/take home exam policy
All assignments are given well in advance and should be completed by the due date (first date). The period between the due date and last date is your sick leave (if you get sick right before it is due you still have more time to complete it). Late work will not be accepted for foreseeable excuses, and for unforeseen events such as illness acceptance requires a documented approved excuse that covers the entire period between the due date and last date accepted.

Dead week
The 5th homework due date will be before dead week, but the last day it is accepted may be in dead week.

Make-up in-class examination policy
Per departmental policy, make-up exams are given only in the following five documented situations.

1. Student’s medical emergency – A doctor’s note on a prescription pad or hospital discharge papers are adequate documentation.
2. Family Emergency - this includes funerals (bring an obituary or funeral program), but not weddings.
3. Extra-Curricular activities as a representative of Iowa State University – your coach or organization director should be able to provide documentation.
4. Armed forces deployment (military duty) – provide a letter or official orders from your commanding officer.
5. Officially Mandated Court Appearance – This includes jury duty.

For foreseeable excuses (3,4,5 above) permission must be requested in advance as soon as the conflict is known. Missed exams under any other circumstances result in a score of zero for that exam.

Disability Information
Iowa State University complies with the American with Disabilities Act and Section 504 of the Rehabilitation Act. If a student has a disability that qualifies and requires accommodations, he/she should contact the Disability Resources (DR) office for information on appropriate policies and procedures. DR is located on the main floor of the Student Services Building, Room 1076; their phone is 515-294-6624. Any student who requires an accommodation under such provisions should contact Leslie Hogben privately as soon as possible and no later than the end
of the second week of class or as soon as documentation of the need for accommodation is obtained. Contact may be made by e-mail (hogben@iastate.edu) or in person (office 488 Carver). No retroactive accommodations will be provided in this class.

**Electronic devices**
Departmental policy is that students are expected to avoid the use of all electronic devices while class is in session, except those used as an official part of the class, and no electronic devices are used during this class. All audible ringers of cell phones, pagers, etc. must be turned off and such electronic devices during class. Calculators, computers, tablets, etc. are not permitted during in-class exams, and all such electronic devices must be turned off and not visible during in-class examinations. Possession of a visible electronic device during an in-class examination is academic misconduct.

**Recording/photography**
Recording or photography during lectures is prohibited without prior written permission of the instructor (Leslie).

**Academic Misconduct**
Any collaboration or use of outside sources on graded work except as expressly permitted constitutes academic misconduct. Conviction of academic misconduct will result in failure of the course. The University's policy on academic dishonesty can be found at: [http://catalog.iastate.edu/academiclife/regulations/#academicdishonestytext](http://catalog.iastate.edu/academiclife/regulations/#academicdishonestytext)

Any change to these policies will be announced in class, by e-mail and on the web-site.