Math 340, Elementary Matrix and Linear Algebra

General Course Information

Credits: 3

Course Designations and Attributes
Breadth – Natural Science
Level – Advanced
L&S Credit – Counts as Liberal Arts and Science credit in L&S

Course Description
Matrix algebra, linear systems of equations, vector spaces, sub-spaces, linear dependence, rank of matrices, determinants, linear transformations, eigenvalues and eigenvectors, diagonalization, inner products and orthogonal vectors, symmetric matrices. Prospective math majors should instead consider MATH 341 for a proof based introductory linear algebra course. Enroll Info: None

Requisites
MATH 222. Not open to students with credit for MATH 341 or 375

Meeting Time and Location
Sec 001: MWF 14:25 - 15:15
Sec 003: MWF 12:05 - 12:55
Location: Van Vleck B130

Instructional Modality
In-person, with online office hours

How Credit Hours are Met by the Course
This class meets for three 50-minute class periods each week and one 50 minute discussion section over the semester and carries the expectation that students will work on course learning activities (reading, writing, problem sets, studying, etc) for at least five hours outside of class each week..

Regular and Substantive Student-Instructor Interaction
The course features three 50-minute blocks of instruction and a 2-hour office hour for guided inquiry weekly. In addition, instructor/student interaction will be implemented through a message board system (piazza) as well as detailed feedback on assessment (e.g., HW and exams).

Instructors & Teaching Assistants

Instructor Title and Name
Dr. Ziquan Yang

Instructor Availability
Office Hour: MW 8:00am - 10:00am
Zoom Meeting ID: 952 0136 3133
Passcode: 340221
Email: zyang352@wisc.edu

Teaching Assistants and availability
Jiwoong Jang (sec 001)
Office Hour: Wed. 3:00pm - 5:00pm
Zoom ID: 929 3366 5307
Passcode: 545088
Email: jjang57@wisc.edu

Jerry Yu Fu (sec 001 and 003)
Office Hour: Mon. 1:00pm - 3:00pm
Zoom ID: 925 9825 0852
Passcode: 397 937
Email: yfu68@wisc.edu

Di Chen (sec 003)
Office Hour: Wed. 2:00pm - 4:00pm
Zoom ID: 972 0622 0872
Passcode: 365 685
Email: dchen263@wisc.edu

Note that you are welcome to attend any TA's office hours. Office hours of TA's from other sections are given below:

Yu Huang (sec 002)
Office Hour: Wed. 1:00pm-3:00pm
Zoom ID: 994 6546 6931
Passcode: 092406
Email: huang76@wisc.edu

Benjamin Wright (sec 002)
Office Hour: Thu. 11:00am-12:00pm
Office Hour Location: Van Vleck Hall room 101
Email: bwright8@wisc.edu

Will Hartdt (sec 004)
Office Hour: TBA
Email: whardt@wisc.edu

Qiao He (sec 004)
Office Hour: TBA
Email: qhe36@wisc.edu

Course Learning Outcomes

At the end of this course students should be able to:

Matrix Algebra: Perform matrix addition, subtraction and multiplication and elementary row operations; solve linear systems of equations using row reduced echelon form of a matrix and invertible matrices; find the inverse of a matrix using row operations and understand properties of invertible matrices.

Determinants: Find the determinant of a matrix using the definition, the properties of determinants and cofactor expansion; understand the relationship between the determinant and the invertibility of a matrix; and solve a system of linear equations using determinants.
Real Vector Spaces: Understand the algebraic structure of a vector space over the real numbers and its subspaces and the span of a set of vectors; linear independence and linear dependence of vectors; find the basis and dimension of a finite dimensional vector space; find the null space, the nullity, the column space and the rank of a matrix; understand coordinates, isomorphisms and change of bases and compute transition matrices.

Linear Transformations: Understand the definition and the properties of a linear transformation between two vector spaces; find the kernel and the range of a linear transformation and the relation between their dimensions; find the matrix of a linear transformation.

Eigenvalues and Eigenvectors: Find eigenvalues and eigenvectors of a linear operator and of a square matrix; diagonalize a linear operator and a square matrix.

Inner Product Spaces: Find the inner product of vectors and the angle between two vectors in an inner product space; and find an orthonormal basis for a finite dimensional inner product space using Gram-Schmidt process.

Grading

- *Homework: 25%*
- *Midterms: 45% (3 exams at 15% each)*
- *Final: 30%*
- *If you have a conflict with any scheduled exam, please contact the instructor well in advance to discuss alternative assessments (i.e., make up exams).Participation in class is highly encouraged, but will not be part of the grade.*
- *Your weighted average will then be assigned a letter grade using the standard UW-Madison denitions (A - Excellent, etc.). The following cutoffs will guarantee the corresponding grade in the course, but I may adjust them in favor of the students at the end of the semester.*
    - *Minimum A - 92*
    - *Minimum AB - 89*
    - *Minimum B - 82*
    - *Minimum BC - 79*

- *Minimum C - 70*
- *Minimum D - 60*

Required Textbook, Software & Other Course Materials

- Title: Elementary Linear Algebra
- Authors: Kolman and Hill
- Publisher: Pearson Edition: 9th

Homework & Other Assignments

- *Homework will be assigned weekly. The lowest three scores will be dropped.*
- *Each homework will consist of selected exercises from the textbook and other sources. I will likely assign many more hw questions than you will do over the term.*
- *From this collection, I will highlight several problems which I recommend that you do if you are able to complete these problems, get correct answers, feel comfortable with the material, etc., then feel free to move along to the next task! If not, then refer to the larger collection of problems for more practice!*
- *From the recommended list, I will identify several problems which I ask you to submit. These problems will be graded *in the same manner as exam questions* so you will be aware of what we are looking for in those assessments. We will use the following scheme:*
  - *5 points: Perfect answer modulo possibly insignificant computational errors.*
  - *4 points: Demonstrates significant understanding of the knowledge which the problem aims to test but contains some gaps/ contains some computational errors.*
  - *3 points: Demonstrates basic understanding of the knowledge which the problem aims to test but is missing some important points/ contains more serious computational errors.*
  - *2 points: Demonstrates some meaningful observations/computations.*
  - *1 points: Shows a meaningful attempt to attack the problem.*
  - *0 points: Blank/No meaningful attempt.*
- *Problems to be submitted should be uploaded to canvas by Friday noon. Unexcused late submissions will not be accepted. Graded homework will be returned by the time the next one is due.*

Exams, Quizzes, Papers & Other Major Graded Work

- *Midterm 1: Oct. 6th 5:30pm or 7:00pm*
- *Midterm 2: Nov. 3rd 5:30pm or 7:00pm*
- *Midterm 3: Dec 1st 5:30pm or 7:00pm*
- *Final Exam: Dec. 22nd, 7:25pm-9:25pm*

General Guidelines for Exam Proctoring

The midterms and the final will be proctored in person, unless some special accommodations are arranged on an individual basis.

Privacy of Student Records & the Use of Audio Recorded Lectures Statement

See more information about privacy of student records and the usage of audio-recorded lectures.

Lecture materials and recordings for this course are protected intellectual property at UW-Madison. Students in this course may use the materials and recordings for their personal use related to participation in this class. Students may also take notes solely for their personal use. If a lecture is not already recorded, you are not authorized to record my lectures without my permission unless you are considered by the university to be a qualified student with a disability requiring accommodation. [Regent Policy Document 4-1] Students may not copy or have lecture materials and recordings outside of class, including posting on internet sites or selling to commercial entities. Students are also prohibited from providing or selling their personal notes to anyone else or being paid for taking notes by any person or commercial firm without the instructor's express written permission. Unauthorized use of these copyrighted lecture materials and recordings constitutes copyright infringement and may be addressed under the university's policies, UWS Chapters 14 and 17, governing student academic and non-academic misconduct.

How to Succeed in This Course

It is a good idea to preview the material before the lectures. Also, practice makes perfect, so doing a lot of exercises from the textbook certainly helps. If you find yourself having trouble understanding certain material, please do not hesitate to ask for help from your peers, instructor or TAs. Chances are that many of your classmates are confused by the same things, so asking questions on Piazza is strongly recommended. Oftentimes you will find that your questions have already been addressed on Piazza, which your instructor and TAs will attend on a regular basis. You may also check out peer-tutoring services on campus.

Here are some useful links:

- *Undergraduate Academic Advising and Career Services*
- *Office of the Registrar*
- *Office of Student Financial Aid*
- *Dean of Students Office*
- *University Health Services*

Diversity & Inclusion Statement

Diversity is a source of strength, creativity, and innovation for UW-Madison. We value the contributions of each person and respect the profound ways their identity, culture, background, experience, status, abilities, and opinion enrich the university community. We commit ourselves to the pursuit of excellence in teaching, research, outreach, and diversity as inextricably linked goals. The University of Wisconsin-Madison fulfills its public mission by creating a welcoming and inclusive community for people from every background – people who as students, faculty, and staff serve Wisconsin and the world.

Academic Integrity Statement

Instructors should discuss academic integrity with students early and often.

By virtue of enrollment, each student agrees to uphold the high academic standards of the University of Wisconsin-Madison; academic misconduct is behavior that negatively impacts the integrity of the institution. Cheating, fabrication, plagiarism, unauthorized collaboration, and helping others commit these

previously listed acts are examples of misconduct which may result in disciplinary action. Examples of disciplinary action include, but is not limited to, failure on the assignment/course, written reprimand, disciplinary probation, suspension, or expulsion.

Accommodations for Students with Disabilities Statement

The University of Wisconsin-Madison supports the right of all enrolled students to a full and equal educational opportunity. The Americans with Disabilities Act (ADA), Wisconsin State Statute (36.12), and UW-Madison policy (UW-855) require the university to provide reasonable accommodations to students with disabilities to access and participate in its academic programs and educational services. Faculty and students share responsibility in the accommodation process. Students are expected to inform faculty [me] of their need for instructional accommodations during the beginning of the semester, or as soon as possible after being approved for accommodations. Faculty [I], will work either directly with the student [you] or in coordination with the McBurney Center to provide reasonable instructional and course-related accommodations. Disability information, including instructional accommodations as part of a student's educational record, is confidential and protected under FERPA. (See: McBurney Disability Resource Center)

Academic Calendar & Religious Observances

You can use the link above to provide your students with information about the current and future academic calendars, along with the university's religious observance policy. As the start-date for the fall 2021 semester coincides with Rosh Hashanah, it is particularly important to reach out to your students and share your plans to provide flexibility for the first day of class.