

MA 511: Linear Algebra with Applications

Summer 2024, Purdue University

Siamak Yassemi

Note: This syllabus is tentative and subject to change.

Course Description:

- (i) Solving and interpretation of linear system of equations, triangular factorization;
 - (ii) matrix algebra;
 - (iii) vector spaces, linear combination, linear (in)dependence, basis and dimensions, linear transformations;
 - (iv) inner product, least squares, Gram-Schmidt process;
 - (v) determinants and their applications;
 - (vi) eigenvalues and eigenvectors, diagonalization process, Jordan canonical form;
 - (vii) symmetric and Hermitian matrices, spectral theorem, quadratic forms, singular value decompositions;
 - (viii) some numerical concepts in matrix computations.
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Instructor:

Siamak Yassemi

Office: MATH 409

Email: syassemi@purdue.edu

Lecture Time and Place:

MTWThF 08:40am - 09:40am, WANG 2599

All lectures will be recorded and posted on Brightspace for all students.

Office Hours:

10 AM-11 AM every Tuesday and Thursday on Zoom, or by appointment. You can find the zoom link to the office hours on Brightspace. Office hours will not be recorded.

Note: This term we will be using class discussion on Brightspace. The system is highly catered to getting you help fast and efficiently from classmates, the TA, and myself.

Rather than emailing questions to the teaching staff, you should post them to the Q&A Forum on Brightspace.

Textbook:

[S] *Linear Algebra and Its Applications*, 4th edition, by Gilbert Strang

Course Outline:

The course will cover most of the sections of [S] Chapters 1 to 6 (plus some additional topics depending on time and interests).

WEEK 1: June 10 -- 14

Matrices and Gaussian Elimination [Section 1.1, 1.2, 1.3, 1.4, 1.6]

WEEK 2: June 17 -- 21

Vector Spaces [Section 2.1, 2.2, 2.3, 2.4, 2.6]

WEEK 3: June 24--28

Orthogonality [Section 3.1, 3.2, 3.3, 3.4]

WEEK 4: July 1--5

Determinant [Section 4.2, 4.3, 4.4]

WEEK 5: July 8--12

Eigenvalues and Eigenvectors [Section 5.1, 5.2, 5.3]

WEEK 6: July 15--19

Application to Differential Equations [Section 5.5, 5.6, 6.1]

WEEK 7: July 22-26

Review, Final Exam

Prerequisites:

Mathematical maturity, in particular, arithmetic proficiency.

Prior experience of linear algebra and vector calculus is desirable.

Homework:

Weekly homework will be gradually assigned as the course progresses.

Please refer to the course announcement below.

- Steps must be shown to explain your answers. No credit will be given for just writing down the answers, even if it is correct.
- For each HW you can only use the materials that are covered before that HW. For example, you should not use determinant before it is taught.
- Staple all loose sheets of your homework to prevent a 5% penalty.
- Resolve any error in the grading (homework and tests) WITHIN ONE WEEK after grading each homework and exam.
- No late homework is accepted (in principle).

Project:

Every student should prepare a report (1-3 pages) on proposing a single application-based question and solve them using the course techniques. For example, Bank Interest (page 254), Markov matrix (page 257), or Application in Economic (page 260). You are free to choose any other applications based on your major. The deadline to submit this note is July 20, 2024.

Examinations:

Midterm Tests: Monday July 08, 2024 (This midterm will be given on Gradescope. It will be closed book/notes, calculators are not allowed. It is strictly prohibited to share or discuss questions with others in any mean. It will open from 12 AM to 11:59 PM July 8. Once you open the exam you will have 75 minutes to finish and submit your answers onto Gradescope).

Final Exam: During Final Exam Week (This Final Exam will be given on Gradescope. It will be closed book/notes, calculators are not allowed. It is strictly prohibited to share or discuss questions with others in any mean. It will open from 12 AM to 11:59 PM ????. Once you open the exam you will have 135 minutes to finish and submit your answers onto Gradescope).

Grading Policy:

Homework (20%)

Project (5%)

Midterm Test (30%)

Final Exam (45%)

The following is departmental policy for the grade cut-offs:

97% of the total points in this course are guaranteed an A+,

93% an A,

90% an A-,

87% a B+,

83% a B

80% a B-,

77% a C+,

73% a C,

70% a C-,

67% a D+,

63% a D, and

60% a D-.

For each of these grades, it's possible that at the end of the semester a lower percentage will be enough to achieve that grade.

You are expected to observe academic honesty to the highest standard. Any form of cheating will automatically lead to an F grade, plus any other disciplinary action, deemed appropriate.

Student Rights:

Any student who has substantial reason to believe that another person is threatening the safety of others by not complying with Protect Purdue protocols is encouraged to report the behavior to and discuss the next steps with their instructor. Students also have the option of reporting the behavior to the [Office of the Student Rights and Responsibilities](#). See also

[Purdue University Bill of Student Rights](#) and the [Violent Behavior Policy](#) under University Resources in Brightspace.

More information on University Policies:

See your MA511 course homepage in Brightspace.

Content (tab at upper left corner): Student Support and Resources, and University Policies and Statements.

Course Progress and Announcement:

(You should consult this section regularly, for homework assignments, additional materials and announcements.)

NOTATION MATTERS!

A clear understanding of the notations is one of the keys to the full appreciation of linear algebra.

For the homework, I believe all the problems should be and can be done by hand. In order to get full credit, sufficient steps must be shown.

You are welcome to use technology to check your answers.