University of International Business and Economics
International Summer School

MAT210 Linear Algebra

Term: June 26-July 23, 2021
Instructor: Sema Salur
Home Institution: University of Rochester
Email: semasalur@gmail.com
Class Hours: Monday through Friday, 120 minutes each day (2,400 minutes in total)
Discussion sessions: TBD
Office Hours: TBD

Total Contact Hours: 64 contact hours (45 minutes each, 48 hours in total)
Credit: 4 units

Course Description:

In the course, the student will gain a familiarity with the theory of linear algebra and its applications. At the same time, more broadly, the student will be introduced to pure (i.e., theoretical) mathematics. That is: the student will increase his/her ability to absorb effectively abstract theory, to read and write mathematically rigorous argument, to extrapolate from fundamental principles, and to attempt creative answers to unfamiliar problems. The student will develop an intuition for theoretical constructs and familiarity with the mathematical style of rigorous argument with which to substantiate that intuition; as well as practice the patience needed to deal with sophisticated mathematical concepts.

Course Goals:

Students who satisfactorily complete this course will:
1. Be familiar with the statements and meanings of the definitions of the fundamental concepts of linear algebra, e.g., vector space, null space, linear independence, basis, dimension, linear transformation, one-to-one, onto, kernel, eigenvector, eigenvalue, orthogonal complement, diagonalizability, etc.
2. Have facility with basic calculational skills, e.g., Gaussian elimination; calculating the determinant, row space, null space, etc. of a matrix; conversion of coordinate vectors between bases; finding the matrix representation of a linear transformation with respect to given bases; determining the eigenspaces of a matrix; etc.
3. Be able to justify, with mathematical rigor, the fundamental theoretical statements of linear algebra (e.g., the fact that a matrix is invertible if and only if its determinant is nonzero; the Rank Theorem; etc.).
4. Have developed the ability to rigorously write mathematical arguments to justify (possibly previously unseen) claims based on their expanding theoretical knowledge.

Required Textbook:

Leon, Steven. Linear Algebra with Applications, 8th edition

Attendance Policy:

Summer school is very intense and to be successful, students need to attend every class. Occasionally, due to illness or other unavoidable circumstance, a student may need to miss a class. A medical certificate is required to be excused. Any absence may impact on the student's grade. Arriving late or leaving early will count as a partial absence. If a student is missing less than a point for a better grade, the better grade will be given, provided the student had no unexcused absences during the course.

Grading Policy:

There will be one midterm and a final exam in this class. All exams will be closed-book. No notes, calculators, or other electronic devices will be allowed.
The course grades will be calculated based on the following percentages:

- Homework: 30%
- Midterm: 30%
- Final Exam: 40%

The final exam will be cumulative. There will be no make-up exams.

Grading Scale:

Assignments and examinations will be graded according to the following grade scale:

A	90-100	**C+**	72-74
A-	85-89	**C**	68-71
B+	82-84	**C-**	64-67
B	78-81	**D**	60-63
B-	75-77	**F**	below 60

Class Rules:

All academic work should be done with the high level of honesty and integrity. Academic misconduct of any kind may result in a grade penalty or the assignment of a failing grade.

Course Schedule:

Week 1
Assignment
Section 1.1: Systems of Linear Equations
Supplementary Problems: 6gh, 8, 9, 10, 11
Section 1.2: Row Echelon Form
Supplementary Problems: 5dkl, 6, 7, 8, 17
Section 1.3: Matrix Arithmetic

Supplementary Problems: 6, 7, 13a, 15, 17
Section 1.4: Matrix Algebra
Supplementary Problems: 3, 7, 12, 20, 21, 26, 29
Section 1.5: Elementary Matrices
Supplementary Problems: 8a, 10c, g, 15, 17, 18, 24, 27
Section 2.1: Matrix Determinant
Supplementary Problems:1, 3dg, 6, 8 (use proof by induction), 10
Section 2.2: Properties of Determinants
Supplementary Problems: 3df, 5, 6, 12, 14, *15, 16
Section 2.3: Matrix Adjoints
Supplementary Problems: 1bd, 6, 10, *12
Discussion session on Saturday

Week 2
Assignment
Section 3.1: Vector Spaces
Supplementary Problems: 6, 8, 10, 15
Section 3.2: Subspaces
Supplementary Problems: 5, 8, 13, 17, 19, 20
Section 3.3: Linear Independence
Supplementary Problems: 2b, 5b, 6, 15, 16, 20
Section 3.4: Basis and Dimension
Supplementary Problems: 10, 13, 17, 19 Section 3.5: Change of Basis
Supplementary Problems: 2, 3, 4, 6, 7, 9, 10
Section 3.6: Row Space and Column Space
Supplementary Problems: 1, 3, 4ef, 8, 10, 14, 17, 19, 24, 26
Section 4.1: Linear Transformations
Supplementary Problems: 1, 3, 7, 8, 9ab, 12, 13, 14, 16, 19, 21, 22
Discussion session on Saturday

Week 3
Assignment
Midterm Exam
Section 4.2: Matrix Representations of Linear Transformations
Supplementary Problems: 3, 5, 6, 7, 9, 14, 16, 17, 18b, 20
Section 4.3: Similarity
Supplementary Problems: 2, 3, 6, 8, 9, 11, 12, 14, 15a*, 15b
Section 5.1: Scalar Product
Supplementary Problems: 3ab, 15
Section 5.2: Orthogonal Subspaces
Supplementary Problems: 1bc, 6, 7, 8, 14, 15, 17
Discussion session on Saturday

Week 4

Assignment

Section 15.3: Method of Least Squares
Supplementary Problems: 1c, 2, 9, 11, 14
Section 5.4: Inner Product Spaces
Supplementary Problems: 3, 4ab, 7ab, 10, 11
Section 5.4: Inner Product Spaces, Part II
Supplementary Problems: *9, 12, 13, 15, 16, 21, 22, *33
Section 5.5: Orthonormal Sets
Supplementary Problems: 2, 5, 6, 8, 12, 15, *20, *36
Section 6.1: Eigenvalues and Eigenvectors
Supplementary Problems: 1acf, 2, 3, 6, 9, 12, 21,*32
Section 6.3: Diagonalization
Supplementary Problems: 1ace, 3, 6
Final Exam
Course Wrap-up on Saturday

General Comments:

1. In order to train your minds in mathematical thinking, much of lecture will consist of the "Socratic Method" of questioning. Even if silently, do try to puzzle out the answers. An analogy: the lecture should be a "mental exercise" class. Knowledge cannot be given: it must be stolen. Engage your mind.
2. Many problems will not be solvable at first (or second) viewing. Be patient: clarify any unknown concepts, try to reduce the problem, brainstorm to unearth possibly relevant concepts, and follow your intuition. It may help to, after a period of hard work, put the problem away. Do not worry if you cannot do every problem: what is important is that you try.
3. If you find yourself getting lost in the material, come to office hours immediately! It is much is easier to lead a student's mind individually rather than in a group.
4. Note that we may not dot every i or cross every t in class: you are responsible for reading the text. In particular, it is to your advantage to read the material before coming to class; in this way the student becomes an active participant rather than a passive recipient.
5. Basic etiquette should be maintained. For example: to give your classmates time to think, please do not blurt out answers unless called upon (or overcome with excitement); please do not walk out of class without prior explanation, etc.
6. Using a cell phone in class is not permitted; students using phones will be penalized 5 percentage points on the next exam.
7. Tests will check your understanding of the lectures as well as cover homework-type problems; it will benefit you to check after each lecture to see if you've understood the line of the arguments. Precise knowledge of the theory is vital!