University of International Business and Economics
International Summer School

MAT 210 Linear Algebra

Term: July 2 – August 2, 2018
Instructor: Colin McLarty
Home Institution: Case Western Reserve University
Email: colin.mclarty@case.edu
Class Hours: Monday through Thursday, 120 minutes each day
Office Hours: TBD
Discussion Session: 2 hours each week

Total Contact Hours: 66 contact hours (45 minutes each)
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 a 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

Grading Policy:
In this course, grading will be based on: Participation 5%; Homework: 15%; Exams: 10%, 20%, and 20%; Final Exam: 30%. **No make-up exams will be given.** Any cheating on exams will result in an automatic zero for that exam.

Grading Scale:
Grades will be curved, with roughly the class mean set as the boundary between a B and a B+, adjusted at the professor's discretion.

Class Rules:
1. Students are expected to attend all classes and be responsible for all material covered in class and otherwise assigned. Any unexcused absence may impact a student's grade. UIBE policy is that a student who has missed more than 1/3 classes of a course will fail the course
2. Students must complete the day's required reading and assignments before class. No late homework will be accepted; unstapled homework will be penalized by 10%. If a student must miss a class due to illness, the assignment should be delivered by an acquaintance by the beginning of lecture. Plagiarism from another student or from a solutions manual will result in fractional or zero credit, respectively.
3. Students should refrain from texting, phoning or engaging in computer activities during class. Any student engaging in such activities during class will be penalized five percentage points on the next exam.

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. UIBE policy requires a medical certificate to be excused. Any unexcused absence may affect the student's grade. Moreover, UIBE policy is that a student who has more than 1/3 of the class in unexcused absences will fail the course.

Course Schedule: (tentative)

Week 1	Assignment
Systems of Linear Equations, Row Echelon Form	1.1: 6gh, 8, 9, 10, 11 1.2: 5dkl, 6, 7, 8, 17
Matrix Arithmetic, Matrix Algebra	1.3: 6, 7, 13a, 15, 17 1.4: 3, 7, 12, 20, 21, 26, 29
Elementary Matrices	1.5: 8a, 10c, g, 15, 17, 18, 24, 27
Matrix Determinant	2.1: 1, 3dg, 6, 8 (use proof by induction), 10

Week 2	Assignment
Exam I; Properties of Determinants; Matrix Adjoints	2.2: 3df, 5, 6, 12, 14, *15, 16 2.3: 1bd, 6, 10, *12
Vector Spaces; Subspaces	3.1: 6, 8, 10, 15; 3.2: 5, 8, 13, 17, 19, 20
Linear Independence	3.3: 2b, 5b, 6, 15, 16, 20
Basis and Dimension	3.4: 10, 13, 17, 19, 5, 8, 9, 11, 13, *18
Week 3	**Assignment**
Change of Basis	3.5: 2, 3, 4, 6,7, 9, 10
Exam II; Row Space and Column Space	3.6: 1, 3, 4ef, 8, 10, 14, 17, 19, 24, 26
Linear Transformations	4.1: 1, 3, 7, 8, 9ab, 12, 13, 14, 16, 19, 21, 22
Matrix Representations of Linear Transformations	4.2: 3, 5, 6, 7, 9, 14, 16, 17, 18b, 20
Week 4	**Assignment**
Similarity; Scalar Product	4.3: 2, 3, 6, 8, 9, 11, 12, 14, 15a*, 15b 5.1: 3ab, 15
Orthogonal Subspaces	5.2: 1bc, 6, 7, 8, 14, 15, 17
Exam III; Method of Least Squares	5.3: 1c, 2, 9, 11, 14
Inner Product Spaces	5.4: 3, 4ab, 7ab, 10, 11
Week 5	**Assignment**
Inner Product Spaces, Part II	5.4: *9, 12, 13, 15, 16, 21, 22, *33
Orthonormal Sets	5.5: 2, 5, 6, 8, 12, 15, *20, *36

Eigenvalues and Eigenvectors; Diagonalization	6.1: 1acf, 2, 3, 6, 9, 12, 21,*32 6.3: 1ace, 3, 6
Final Exam	

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!