MATH 677 — Mathematical Foundations for Data Science *

MWF 8:00-8:50, Blocker Building, Room 163

Instructor: Simon Foucart, 502D Blocker Building, foucart@tamu.edu
Office hours: M 9-9:30am, Tu 5-5:30pm, W 11-11:30am, and by appointment
Course web page: www.math.tamu.edu/~foucart/teaching/notes/MFDS21
Textbook: None, but the following resources might be useful:

- *Linear Algebra and Learning from Data*, by Strang. SIAM.
- *Matrix Methods in Data Mining and Pattern Recognition*, by Eldén. SIAM.
- *Mathematics for Machine Learning*, by Deisenroth, Faisal, and Ong. CUP.
- *Foundations of Data Science*, by Blum, Hopcroft, and Kannan. CUP.

Course Description: Linear systems; least squares problems; eigenvalue decomposition; singular value decomposition; Perron–Frobenius theory; dynamic programming; convex optimization; gradient descent; linear programming; semidefinite programming; compressive sensing.

Prerequisites and Restrictions: Grade C or better in MATH 304, MATH 309, MATH 311, MATH 323, or equivalent.

Exams: There will be one midterm exam and one final exam.

Homework: Homework is an integral part of the course. In particular, it will contain some programming exercises chosen to illustrate the concepts and techniques expected to be mastered. Homework problems will be assigned weekly, some of which will be graded. The graded problems will be collected at the beginning of class on the due date. Late homework will not be accepted. You are encouraged to come and see me during my office hours to obtain some help on particular questions, provided you made a genuine attempt to solve them.

Grading: Grades are based on the work shown, not on what was intended or implied. Excessively sloppy, poorly justified and disorganized work cannot be given full credit, even if the correct answer appears. The final grade is assigned according to the following scheme:

- Homework   50 points
- Midterm   50 points
- Final   100 points

The point scale used to determine the final letter grade is

F: 0–99,   D: 100–119,   C: 120–139,   B: 140–159,   A: 160-200.

Make-ups will only be given in case of university excused absences or in exceptional circumstances (illness, injury, etc.), which should be documented. The instructor's prior approval is necessary.

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*this syllabus is a general plan for the course; deviations announced in class may be necessary

Tentative schedule:

Week 01 (Aug 30-Sep 03)	Review of linear algebra	F 03: last day for add/drop
Week 02 (Sep 06-Sep 10)	Solving linear systems	
Week 03 (Sep 13-Sep 17)	Solving least squares problems	
Week 04 (Sep 20-Sep 24)	Eigenvalues/vectors	
Week 05 (Sep 27-Oct 01)	Singular values/vectors	
Week 06 (Oct 04-Oct 08)	Perron-Frobenius theory	
Week 07 (Oct 11-Oct 15)	Review, Midterm	
Week 08 (Oct 18-Oct 22)	Dynamic programming	
Week 09 (Oct 25-Oct 29)	General optimization problems	
Week 10 (Nov 01-Nov 05)	Convex programming	
Week 11 (Nov 08-Nov 12)	Gradient descent, variations	
Week 12 (Nov 15-Nov 19)	Linear programming	F 19: last day for Q-drop
Week 13 (Nov 22-Nov 26)	Semidefinite programming	W 24, F 26: no class
Week 14 (Nov 29-Dec 03)	Compressive sensing	
Week 15 (Dec 06-Dec 10)	Review, Final	F 10, 10am-noon: Final

Attendance Policy: Attendance is not compulsory, but regular attendance is expected — it is in fact essential if you want to do well in the course. Classes to be missed due to religious holidays must be communicated to me during the first week. You are required to arrive on time and stay the length of the class. If you do not attend a class, you are responsible for any announcement made, any material covered, and any additional topic introduced during this class. Office hours cannot be used for this purpose.

Electronic Etiquette: Laptops and tablets are not allowed (unless it is demonstrated that they are used for note-taking only). Cell phones must absolutely be put on silent mode, left closed, and put away. If you have a family emergency and need to take a call during class, I shall be notified in advance so that a special arrangement can be made.

Academic Honesty: *"An Aggie does not lie, cheat, or steal or tolerate those who do."*
See `http://aggiehonor.tamu.edu` for more information.

Americans with Disabilities: The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact Disability Services, currently located in the Disability Services building at the Student Services at White Creek complex on west campus or call 979-845-1637. For additional information, visit `http://disability.tamu.edu`.