# FoDA Syllabus

## CS/DS 3190

January 5, 2026

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# Course Management

- Webpage (https://users.cs.utah.edu/~jeffp/teaching/FoDA.html): schedule
- Canvas: communication, grades
- GradeScope: homeworks, grading

| Date | Chapter | Video | Topic | Assignment |
|---|---|---|---|---|
| Mon 1.05 | | | Class Overview | |
| Wed 1.07 | Ch 1 - 1.2 | | Probability Review : Sample Space, Random Variables, Independence | **Quiz 0** |
| Mon 1.12 | Ch 1.3 - 1.6 | | Probability Review : PDFs, CDFs, Expectation, Variance, Joint and Marginal Distributions(colab) | HW1 out |
| Wed 1.14 | Ch 1.7 | | Bayes' Rule: MLEs and Log-likelihoods | |
| Mon 1.19 | | | MLK DAY | |
| Wed 1.21 | Ch 1.8 | | Bayes Rule : Bayesian Reasoning | **Quiz 1** |
| Mon 1.26 | Ch 2.1 - 2.2 | | Convergence : Central Limit Theorem and Estimation (colab) | |
| Wed 1.28 | Ch 2.3 | | Convergence : PAC Algorithms and Concentration of Measure | HW 1 due |
| Mon 2.02 | Ch 3.1 - 3.2 | | Linear Algebra Review : Vectors, Matrices, Multiplication and Scaling | HW 2 out |
| Wed 2.04 | Ch 3.3 - 3.5 | | Linear Algebra Review : Norms, Linear Independence, Rank and numpy (colab) | **Quiz 2** |
| Mon 2.09 | Ch 3.6 - 3.8 | | Linear Algebra Review : Inverse, Orthogonality | |
| Wed 2.11 | Ch 5.1 | | Linear Regression : explanatory & dependent variables (colab) | HW 2 due |
| Mon 2.16 | | | PRESIDENTS DAY | HW 3 out |
| Wed 2.18 | Ch 5.2-5.3 | | Linear Regression : multiple regression (colab), polynomial regression (colab) | **Quiz 3** |
| Mon 2.23 | Ch 5.4 | | Linear Regression : overfitting and cross-validation + double descent (colab) | |
| Wed 2.25 | Ch 6.1 - 6.2 | | Gradient Descent : functions, minimum, maximum, convexity & gradients | HW 3 due |
| Mon 3.02 | Ch 6.3 | | Gradient Descent : algorithmic & convergence (colab) | HW 4 out |
| Wed 3.04 | Ch 6.4 | | Gradient Descent : fitting models to data and stochastic gradient descent | **Quiz 4** |
| Mon 3.09 | | | SPRING BREAK | |
| Wed 3.11 | | | SPRING BREAK | |
| Mon 3.16 | Ch 7.1 - 7.2 | | Dimensionality Reduction : project onto a basis | |
| Wed 3.18 | Ch 7.2 - 7.3 | | Dimensionality Reduction : SVD and rank-k approximation (colab) | HW 4 due |
| Mon 3.23 | Ch 7.4 | | Dimensionality Reduction : eigndecomposition and power method (colab) | HW 5 out |
| Wed 3.25 | Ch 7.5 - 7.6 | | Dimensionality Reduction : PCA, centering (colab), and MDS (colab) | **Quiz 5** |

# Expected Learning Outcomes

On completion of the course, students should be able to:

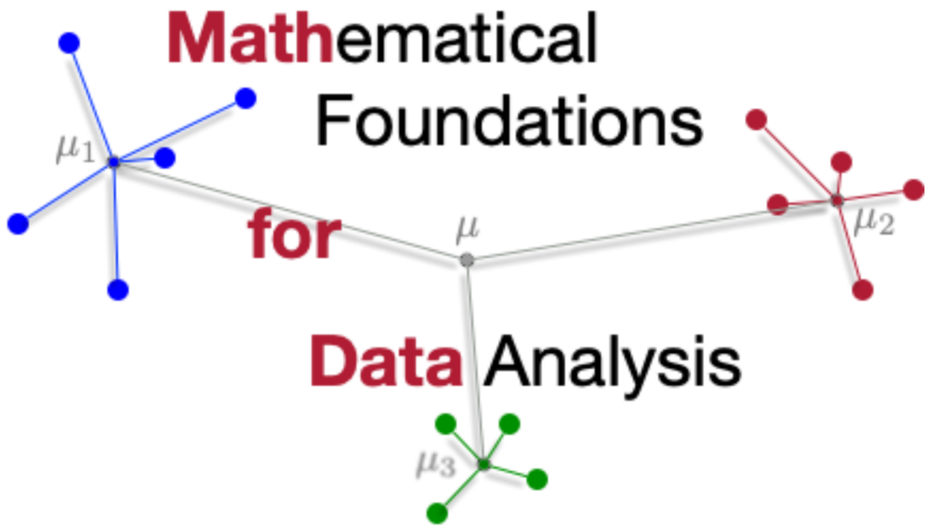
1. To represent data points as **vectors** and data sets as **matrices**, and manipulate them with tool from **linear algebra**.
2. To understand how to express a **model** to fit data as **geometric object** represented by a small number of parameters,
   with the goal of minimizing **sum of squared errors**, and
   motivated by **probability** assuming **iid data**.
3. To understand basic formulations, models, and algorithms for goals in
   **linear regression**, **dimensionality reduction**, **clustering**, and **classification**.
4. To be able to **optimize** a convex function with **gradient descent**,
   and how to apply these tools to optimize model parameters with respect to a cost function derived from data.
5. To evaluate **supervised learning problems** (regression and classification), by how well they generalize to new data, with **cross-validation**.

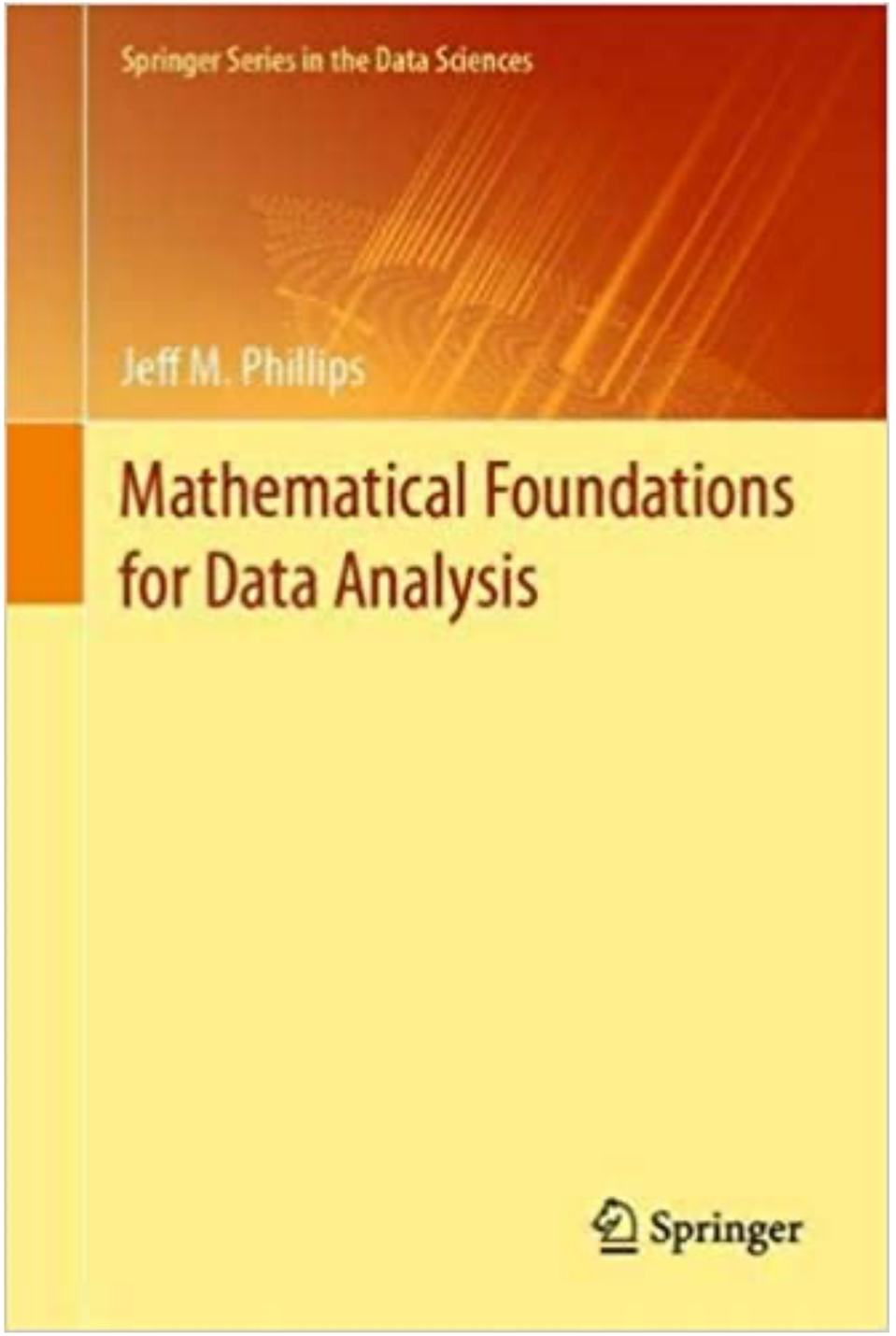
# Mathematical Foundations for Data Analysis

by Jeff M. Phillips

http://mathfordata.github.io

## Math for Data



# Personnel

**Instructor : Jeff Phillips (email)**
**Office hours: Thursdays 9-10am (MEB 3404) and directly after each class**

**TAs:**
**Arman Ashkari (arman.ashkari@utah.edu)**
**Office hours: Mondays 11am-1pm (TBA)**

**Lucas Pearce (u1110118@utah.edu)**
**Office hours: Tuesdays 3:30-5:30pm (TBA)**

# Homeworks

- Every other Wednesday @ 2:30 (then come to class)
- 10% off (0 - 24 late],  20% off (24 - 48 hours] late, then 0 points
- Drop lowest **if you complete all homeworks**, even >48 hours late ok
- Submit to GradeScope.  Regrade requests within 1 week.
- Ask questions in Canvas Discussion Board (or Help Hours)

# Collaboration Policy

**Will be on Quiz 0**

For assignments, you **may discuss questions with anyone, including problem approach, proofs, and code.**

But **all students must write their own code, proofs, and write-ups**.
If you collaborated with another student on homeworks to the extent that you expect your answers may start to look similar, you must explain the extent to which you collaborated explicitly on the homework. Students whose homeworks appear too similar, and did not explain the collaboration will get a 0 on that assignment.

For quizzes and exam, **you must work by yourself**.
Students talking during exams without the instructor or TA present will have their tests confiscated and receive a 0.

# Cheating Policy

A cheating sanction on a **homework** will be given to a student if they:

- **copy answers** directly from someone else, or a leaked online version of answers,
- ***allow*** *another student to directly copy answers* from them, or
- *directly reproduce* answers from **generative AI**.

Using online resources to help formulate answers is acceptable. Blatant direct copying is not ok.

A cheating sanction on a **quiz or exam** will given to a student if they:

- **talk** without a TA/instructor present.
- **copy** from another student or not allowed resource

A less-than-fail sanction will be triggered by a cheating sanction on a single homework or quiz. The student will get a 0 on that object, and will not be able to drop the score in the average. A failing sanction will be triggered by more than one cheating sanction among homeworks or quizzes, or a cheating sanction on the final.

https://www.cs.utah.edu/docs/misc/cheating_policy.pdf

# Generative AI

**Will be on Quiz 0**

Generative AI tools are very powerful and useful for work in data analysis, and I expect you will heavily use them through your career. Yet, it will continue to be important to know when to trust the answers they provide – and these skills are some of the most import aspects of this course. Some common misconceptions related to this course are widely spread in some of the data on the web, and that AI is trained on.

While *you are encouraged to use generate AI* (e.g., chatGPT) and other resources (e.g., 3Blue1Brown), there is a danger – especially with generative AI – to directly replace learning with its answers. So

- **do not directly post homework questions into chatGPT** (or similar tools), and
- **do not directly retrieve answers from them and put them in homework as your own**.

If we uncover evidence of this, it will result in a sanction for students.

# Quizzes

- Every other Wednesday **last 20-30 minutes of class**
  (opposite week with homework)

- **In class** on paper. Should *usually* take **<10 minutes** if following material

- On material since the prior quiz (including that lecture)

- **Drop lowest score**, so ok to miss one quiz
  (make up quizzes will be very rare exceptions, is excused for multiple)

- Can use 1 side of 1 sheet, with anything on it.
  no calculators, computers, phones

- **No talking** unless TA/instructor present. Raise hand if question.

# Student Support

See Syllabus for details on

- Disabilities Services
  Register for **Center for Disability Services** now if needed.
- English as Second Language
- Safety
- Wellness
- Veteran Support

# Quiz 0

- On Wednesday (in class!)
- This is a practice for future quizzes
  (only worth half as much as regular)
- Tests on syllabus:
  force you to understand **collaboration** and **AI policies**
- For us to get feedback on Help Hours