Massachusetts Institute of Technology
Department of Electrical Engineering and Computer Science
6.7800 Inference and Information
Spring 2026

Information Sheet

Lecturer

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Lectures:	Tuesday and Thursday, 9:30am–11am, Room 32-123
Recitations:	Friday, 1–2pm or 2–3pm, Room 4-257
Office Hours:	Days, times and locations posted on course site
Bonus Sessions:	Dates, times, and locations to be announced

Welcome to 6.7800 !

This course offers an immersive graduate-level introduction to the principles of statistical inference, with an emphasis on information theoretic perspectives. As such, it is a core graduate subject for students in the relevant subfields both within and beyond Course 6 (EECS). The material in this course constitutes part of a common foundation for work in, for example, machine learning and data science, artificial intelligence, signal processing, computer vision and computational imaging, natural language processing, communication, bioinformatics and neuroscience, finance and data analytics, and networks, robotics, and control.

It is worth stressing that 6.7800 is an *introductory* graduate subject: it is *not* an advanced graduate subject for students who have already mastered graduate-level statistics, estimation and decision theory, and information theory, and now want to understand such material at an even more sophisticated level. That said, by its structure, 6.7800 will ultimately reveal connections among these fields, and provide background for more advanced treatments.

Ultimately, the course is about teaching you the basis for contemporary approaches to—and perspectives on—problems of statistical inference and learning. The development of the material that forms the core of this subject is strongly driven by applications. However, our focus in the course will not be on these applications—which form the basis for entire courses of their own—but rather on the common problem-solving frameworks that they share. Nevertheless, we will cite various relevant applications as we develop the material and sometimes extract simplified illustrative examples from these contexts.

As with other core subjects, 6.7800 has lectures and recitations, which are designed to complement each other. The class is intended as a fully in-person experience, and we look forward to interacting with you in the classroom! Recitations begin the first week of classes. There are two possible recitation times from which you can choose. Select to attend whichever suits your schedule best. During the semester there will also be occasional (and entirely optional) "bonus" sessions for those eager to see interesting applications and extensions of the basic material. The specific dates, times, and rooms will be announced on the class website. Finally, the course staff will hold several scheduled office hours throughout the week, the details of which are provided on the class website. Like lectures and recitations, office hours are also fully in-person experiences, and a great place to interact not only with the staff, but with your fellow classmates as well. We look forward to getting to know you and helping you absorb the material and get the most out of your 6.7800 experience!

Prerequisites

The official prerequisite is 6.3800[6.008], 6.3700[6.041]/6.3702[6.431], 18.600, or 6.7700 [6.436]. The effective prerequisite is *fluency* with basic quantitative probabilistic reasoning and analysis, together with the kind of mathematical maturity that often comes from taking at least one higher level undergraduate subject that has a significant mathematical component. As such, a student having had 6.7700[6.436] would be sufficiently well prepared, while a student having only had 6.3800[6.008], 6.3700[6.041]/6.3702[6.431], or 18.600 and no subsequent subjects of a strong mathematical flavor would likely need additional preparation. As an example, having had one of these subjects together with an introductory subject in real analysis (e.g., 18.100), would be sufficient, but not necessary, preparation. Ultimately, students who come into the class properly prepared and seasoned get much more out of the experience.

When in doubt, students whose undergraduate degrees are not from MIT should consult the staff to determine if they have had subjects that are effectively equivalent to the official prerequisites.

Reading

There are extensive and detailed course notes for the class, which you will access by clicking on the Files tab in the navigation bar of the class website and going to the Course Notes section. The notes will be posted one section at a time over the course of the semester, with each installment posted (at least a little) in advance of its corresponding lecture(s). These notes are under perpetually active development, and as such are necessarily rough in places and contain bugs, which we will count on you to help us catch. Also, sometimes a section or subsection of the notes will be marked with a "$*$" after its number. Such sections constitute bonus material and thus completely optional reading; read them as your interests dictate and your time permits.

More generally, if you are interested in further reading, either to strengthen your background, reinforce some of the concepts from lecture, or to probe some topics in more detail, you might want to take a look at the additional references on the course website, which have been selected with some care. To find them, click the Files tab in the navigation bar of the class website and go to the Further Reading section. In particular, you'll find several papers containing a variety of useful insights, which you may enjoy.

We emphasize that the course notes do *not* replace the lectures and recitations. The notes will be necessarily incomplete, and much of the intuition will be developed in class, along with many of the perspectives, interpretations, and insights. Conversely, lectures and recitations are not a substitute for the notes. Indeed, we will defer many details of our development to the reading materials. Thus, you should view class and the written materials as strongly complementary.

Problem Sets, Exercises, and Practice Problems

There will be 10 problem sets, which are issued and due according the class schedule at the end of this handout. Problem sets are due by 10pm on the Wednesday they are due (except for the final problem set, which is never due). You will submit your problem set by scanning it and uploading to Gradescope, which you can also access via the class web site. Problem set solutions will be available on the class website one week after the due date.

To provide some flexibility in your schedule, each of you will have a "late problem set" budget of 7 days for the semester. When you hand in a problem set late, your remaining budget will be reduced by the corresponding number of days, and the remainder is available for you to use for subsequent problem set submissions. So long as you have not exceeded your budget, your problem set will be graded without penalty. If you complete and submit your problem set late but have exceeded your budget, it will be recorded as completed, but not graded.

While you should do all the assigned problems, only a randomly chosen subset will actually be graded. We can't emphasize enough: well beyond its weighting in the final grade, working through (and, yes, often struggling with at length!) the homework is a crucial part of the learning process and will invariably have a major impact on your understanding of the material. Some of the problem sets involve a PYTHON component, to help you explore different aspects of the material. Additionally, some of the problems have extra parts labeled "practice"—you are free to do these parts for extra practice with the concepts from class, but they are never graded, so do not submit your answers to these parts.

Many students find collaborating with one or two classmates on the problem sets helpful, and we very much support and encourage this. Just remember that your writeup (and all code) needs to be your own, and you need to identify your collaborators in your writeup. Ways for finding partners are discussed later in this handout.

To help you get started with the problem sets, there will be an accompanying exercises handout posted on the website at the same time. These exercises are simpler worked examples that illustrate some of the basic calculations that the problem sets will, in turn, build on. You're free to use these exercises in any way you find helpful to you in preparing for the homework.

In addition, for every problem set, we will provide a companion set of practice problems (with solutions) as a separate handout, also at the same time. Use them in any way that is helpful to you as well. For example, you might find it worthwhile to work through some of them if you are looking for more practice with the concepts introduced in class.

Project

In addition to the problem sets, the class will include a two-part PYTHON-based class project. Part I will be a guided exercise, while the continuation Part II will be a more open-ended challenge. The project is intended to be educational, interesting, and fun! The project will go out on Wednesday, April 15, and Part I will be due the following Wednesday. There will be no problem set issued during Part I of the project. Part II will be due on Friday, May 8. These details are summarized in the class schedule. You may want to make a note of the project dates in your calendar now, to help you with planning your time and coordinating with other classes during the semester.

The project details will be announced closer to the time it goes out, but plan on an interesting and engaging experience with the material.

Exams

There will be two quizzes in the subject. The midterm quiz will be held on Wednesday, April 8, 7:30–10:30pm in 32-141. The final quiz will be held on Monday, May 18, 9:00am-12:00pm in Johnson Athletic Center (Track). The date of the final quiz will be announced by the Registrar early in the semester. The quizzes will both be *closed* *book*. You will be allowed to have *two* 8.5×11-inch sheet of notes (both sides) for the midterm quiz, and *four* 8.5×11-inch sheets of notes for the final quiz.

Class Grade

The final grade in the class is based upon our best assessment of your understanding of the material during the semester. Roughly, the weights used in grade assignment will be:

Midterm Quiz	35%
Final Quiz	35%
Homework	20%
Project	10%

with an additional property that if you do better on the final quiz than the midterm quiz, and you have completed all the problem sets and the project, then the midterm quiz will not count, i.e., the midterm quiz can only help you if you are doing all the homework. Also, the project must be completed to receive a grade in the subject.

As always, other factors such as contributions to the lecture discussion and other interactions can make a significant difference in the final grade.

Working with Your Classmates

One of the most important aspects of the experience of taking a subject at MIT like 6.7800 is the community of people you are taking the subject with. This community forms and bonds naturally through side conversations and interactions among you in and outside of the classroom, and in working through homework, as you navigate the semester together. Out of that shared experience often emerge collaborations and friendships that endure long after the subject is over.

While many of you will meet classmates to interact with in lecture, recitation, and office hours, some of you may find joining Pset Partners helpful for this purpose. This is an online system developed at MIT that matches students to small groups for working on problem sets, based on the preferences specified by each student. The first matching round will take place on February 6.

Online Platforms and Resources

We will make use of the following online platforms and resources in 6.7800.

Canvas, Athena, Certificates

We will post information and handouts on the 6.7800 class website, which resides on the Canvas platform:

`https://canvas.mit.edu/courses/36990`

You will need to have an active MIT Kerberos account and be on the official course list to access the website. If you have pre-registered for 6.7800, this should have already been set up; just double-check that you can access the website (try to download a handout, for example). Otherwise, contact one of the TAs.

For information on setting up an MIT Kerberos account, visit http://ist.mit.edu/support/accounts/. You may (or may not) also need a valid MIT certificate; if necessary, visit https://ca.mit.edu/ca/ for information on getting one. If you have problems or if you are not a regular MIT student, please contact one of the TAs for assistance.

Gradescope

You will submit homework and quizzes on Gradescope, which you can access via Gradescope or the corresponding tab in the navigation bar of the class website and logging in with your MIT credentials.

Piazza

We will use Piazza for announcements and as an online discussion forum. You can access (and enroll yourself in) via the link Piazza Forum or via the corresponding tab in the navigation bar of the class website. Through Piazza you can post questions or comments (anonymously to your peers) about any aspects of the material, which your peers and the staff can respond to. It is a popular online resource in the course for clarifying potential points of confusion in class notes, problem sets, recitation handouts, the project, etc.

Email

Finally, if you have administrative questions during the term, you can send email to

6.7800-admin@mit.edu

We will be glad to help you, but please be sure that your question isn't already answered in this handout before you email us!

Tentative Syllabus and Schedule

	Date		Topic	Out	Due
T	2/03	L1	Introduction and overview		
W	2/04			PS1 (L1,L2)	
R	2/05	L2	Bayesian hypothesis testing		
T	2/10	L3	NonBayesian decision theory		
W	2/11			PS2 (L3-L5)	PS1
R	2/12	L4	Minimax decision theory		
T	2/17		*Monday schedule – no class*		
R	2/19	L5	Bayesian estimation and geometry		
T	2/24	L6	NonBayesian parameter estimation		
W	2/25			PS3 (L6,L7)	PS2
R	2/26	L7	Exponential families		
T	3/03	L8	Sufficient statistics		
W	3/04			PS4 (L8,L9)	PS3
R	3/05	L9	The EM algorithm		
F	3/06		*Add Date*		
T	3/10	L10	Inference as decision		
W	3/11			PS5 (L10,L11)	PS4
R	3/12	L11	Information geometry		
T	3/17	L12	Modeling as inference		
W	3/18			PS6 (L12,L13)	PS5
R	3/19	L13	Extensions to continuous parameters		
	3/23-3/27		*Spring Break*		
T	3/31	L14	Priors		
W	4/01			PS7 (L14-L16)	PS6
R	4/02	L15	ML geometry and alternating projections		
T	4/07	L16	Stochastic approximation, MCMC		
W	4/08	Q	**Midterm Quiz** (through L13 and PS6)		
R	4/09		*No Class*		
T	4/14	L17	Asymptotics: typicality, large deviations		
W	4/15			Project	PS7
R	4/16	L18	Method of types and Sanov's theorem		
M	4/20		*Patriots Day holiday*		
T	4/21	L19	Asymptotics of hypothesis testing *Drop Date*		
W	4/22			PS8 (L17-L19)	Project, Part I
R	4/23	L20	Asymptotics of estimation		
T	4/28	L21	Asymptotics of inference and universality		
W	4/29			PS9 (L20-L22)	PS8
R	4/30	L22	Asymptotics of model capacity		
T	5/05	L23	Nested classes and model order selection		
W	5/06			PS10† (L23-L25)	PS9
R	5/07	L24	Variational and nonparametric inference		
F	5/08				Project, Part II
T	5/12	L25	Score-matching methods and diffusion		
	5/15-5/20	Q	**Final Quiz** (through L25 and PS10)		

† Never due.