
Instructor: Gustavo de Veciana, Office: EER 6.874

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Teaching Assistant: Parikshit Hegde

Class time: Tu Thu 9:30-11am and conducted in person ECJ 1.312

Office hours: for the instructor will be in person (limited to 4 people in my office) and scheduled on Zoom for the TA, see *posted/updated* on Canvas

Overview: This course is intended for graduate students with a background in probability and ideally some background/interest in communications, systems, signal processing and/or data sciences. The focus will be on developing the *foundations of Information Theory* including most of the key results and applications. That said the last third of the class may include some novel more research oriented topics presented and/or intriguing applications presented by the students and myself.

Pre-requisites: A prerequisite for this course is a graduate course in Probability and Stochastic Processes , such as EE381J.

Required textbook: Elements of Information Theory, by Cover and Thomas. Wiley, 2006. Second Edition

Online course platforms: We will be using the following platforms

- *UT Canvas* –course management platform– will be used for posting class material/homework/solutions etc.
- *Piazza* – you will be encouraged to please post and answer questions regarding the course to your peers and course staff.
- *Gradescope* – electronic homework submission and homework/exam grading platform.
- *Exams* : Exams will be conducted in person.

Teaching Assistant: The course TA will be Parikshit Hegde. Details on the TA contact information, meeting times and location are available on Canvas.

General course policies: Some general principles for this course.

Class participation/attendance is encouraged/expected. The class is intended to engage you and your colleagues in reconnecting and enjoying intellectual pursuits together in person. The aim of the in class lectures and activities is to jump start your understanding and stimulate your interest. Note you are responsible for the material in the **reading assignments** as well as what is **covered in class**.

Homework is important and will be assigned regularly: Homework will be assigned weekly except on weeks when you have a midterm. You are encouraged to work together in groups of say no more than 4, and to turn in a single team effort homework for your group. Take the opportunity to explain the concepts to each other. This is a great way to learn. You will need to scan your homework and submit it electronically via Gradescope *before 6pm on Friday*. Please indicate these are joint submissions and whom was on your group. To that end you will need to set up a Gradescope account (instructions will be emailed to you) and details on pdf scanning and uploading homeworks are included in your first homework.

No late homeworks will be accepted. If you miss a homework no problem, the homework with the lowest score will be dropped when computing your overall homework grade.

Exams: There will be two midterms and a final exam taken online as follows:

- Midterm 1 – *Thursday, March 3, 9:30-10:45am*
- Midterm 2 – *Thursday, April 7, 9:30-10:45am*

Exams will be held in class, will be closed book but you will be allowed to bring a single cheat-sheet (8.5 x 11 inch paper) to each exam.

No make up exams will be given. If you will miss an exam you need to let the instructor know *prior* to the exam. The instructor will determine if the absence is excused on a case-by-case basis based on concrete material. For an excused absence, the exam score will be calculated as the weighted average of the other mid-term exam and final scores based on their relative weights. Unexcused absences will result in zero points for the exam.

Course project – student presentations. As part of this course you will be asked to prepare a presentation on an Information theory centered topic of interest to you. This may be more research-oriented or may simply something you want to learn about and explore a bit. You are once again encouraged to do this as a group of no more than 4 people. More details on topics and format can be found on canvas. You will be expected to attend and evaluate your colleagues presentations. Depending on the size of the class and number of groups this may occur during the **finals week**, i.e., in particular

- Student Presentations – **may occur** last weeks of class or during the finals time for this class, i.e., *Saturday May 14, 2:00-5:00 pm.*

Grading: Your final grade will be determined based on your work throughout the semester as follows:

Homework	30%
Participation	5%
Midterm 1	25%
Midterm 2	25%
Presentation	15%

Prompt grading and regrade requests. We will grade promptly, and will consider regrade requests only within *two weeks* of time/date the graded homework/exam is returned (i.e., made available) on Gradescope. You are encouraged to discuss requests with the course staff, however requests must be submitted via Gradescope, with a brief written justification. No grade changes will be made in any students presence.

Fair and transparent grading. The midterm and final exams will be individually curved to permit you to track how you are doing throughout the semester. Homework will be graded in a rough manner, i.e., -,ok,+ and will not be curved. Grade cutoffs will be as follows:

A	A-	B+	B	B-	C+	C	C-	D+	D	D-	F
90	86.67	83.34	80.00	76.67	73.34	70.00	66.67	63.34	60	56.67	53.34

The TA and I are here to help do not hesitate to reach out and talk to us.

Some important notes: The university has a variety of resources that can be extremely useful and exist to serve our community. Please contact appropriate offices as detailed below.

University Honor Code: “The core values of The University of Texas at Austin are learning, discovery, freedom, leadership, individual opportunity, and responsibility. Each member of the University is expected to uphold these values through integrity, honesty, fairness, and respect toward peers and community.”
<http://www.utexas.edu/about/mission-and-values>.

Academic adjustment: The University of Texas at Austin provides, upon request, appropriate academic adjustments for qualified students with disabilities. Contact Services for Students with Disabilities at (512) 471-6259 [voice], (866) 329-3986 [video], ssd@uts.cc.utexas.edu, or
<http://ddce.utexas.edu/disability>.

Wellness: You are at a top university and dealing with lots of stress and demands which can be intense. I encourage you to take care of yourself. Do your best to maintain a healthy lifestyle this semester by eating well, exercising, socializing, getting enough sleep and taking some time to relax. This will help you achieve your goals and cope with stress. All of us benefit from support during times of struggle. If you are having any problems or concerns, do not hesitate to come speak to the TA and myself. There are also many resources available on campus that can provide help and support. Asking for support sooner rather than later is almost always a good idea. If you or anyone you know experiences any academic stress, difficult life events, or feelings like anxiety or depression, we strongly encourage you to seek support. Counselors are available Monday-Friday 8am–5pm at the UT Counseling and Mental Health Center (CMHC) on the 5th floor of the Student Services Building (SSB) in person and by phone (512-471-3515). The 24/7 UT Crisis Line is 512-471-2255. Consider also reaching out to a friend, faculty member, or family member you trust to help get you the support you need.

Campus Carry: “The University of Texas at Austin is committed to providing a safe environment for students, employees, university affiliates, and visitors, and respecting the right of individuals who are licensed to carry a handgun as permitted by Texas state law.” For more information, please see
<http://campuscarry.utexas.edu/students>.

Date	Lecture Topic	Reading	HW-due
Tu 1/18 Th 1/20	L1: Intro, Entropy, Relative Entropy, Mutual Information L2: Properties of Entropy and Chain Rule	1, 2.1-2.5	1
Tu 1/25 Th 1/27	L3: Inequalities L4: Asymptotic Equipartition Property	2.6-2.10 3	2
Tu 2/1 Th 2/3	L5: Entropy rates of a random process L6: Data Compression - Part 1	4 5.1-5.8	3
Tu 2/8 Th 2/10	L7: Data Compression - Part 2 L8: Gambling and Data Compression	5.9-5.11 6.1-6.6	4
Tu 2/15 Th 2/17	L9: Kolmogorov Complexity - Part 1 L10: Kolmogorov Complexity - Part 2	14	5
Tu 2/22 Th 2/24	L11: Channel Capacity - Part 1 L12: Channel Capacity - Part 2	7	6
Tu 3/1 Th 3/3	L13: Differential Entropy In class Midterm 1 covering L1 – L12	8	
Tu 3/8 Th 3/10	L14: Gaussian Channels - Part 1 L15: Gaussian Channels - Part 2	9	7
Tu 3/15 Th 3/16	Spring Break		
Tu 3/22 Th 3/24	L16: Maximum Entropy and Spectral Estimation L17: Information Theory and Statistics - Part 1	12 11.1-11.5	8
Tu 3/29 Th 3/31	L18: Information Theory and Statistics - Part 2 L19: Rate Distortion Theory	11.6-11.10 10	9
Tu 4/5 Th 4/7	L20: Network Information Theory - Part 1 In class Midterm 2 covering L13 – L19	15.1-15.5	
Tu 4/12 Th 4/14	L21: Network Information Theory - Part 2 L22: Network Information Theory - Part 3	15.6-15.10	10
Tu 4/19 Th 4/21	L23: To Be Determined L24: To Be Determined		11
Tu 4/26 Th 4/28	L25: To Be Determined L26: Student Presentations		
Tu 5/3 Th 5/5	L27: Student Presentations L28: Student Presentations		
Sa 5/14	Additional Student Presentations - Sat. May 14, 2-5pm		