Syllabus ENGG 107: Bayesian Statistical Modeling and Computation
Last update: Jan 3, 2023
Winter 2023
Schedule: 11 time-frame
Room: 009 Engineering & Computer Sciences Center
Classes: MWF 11:30 – 12:35
Problem Set Re-/Pre-views: Fridays 14:00-15:00
Office Hours: Fridays 15-16:30

Instructor: Professor Klaus Keller
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Office Phone: +1 (603) 646-3481
Office: IR 385, Irving Institute for Energy and Society
Office Hours: Fridays 15:00-17:00
By appointment (scheduled via email or simply after a class session)
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TA: Prabhat Hedge

Course Description[1]

This course will introduce Bayesian approaches to statistical modeling as well as the computational methods necessary to implement these approaches in research and applications. We will cover methods of statistical learning and inference for a variety of subject areas. Students will have the opportunity to apply these concepts and methods in the context of their own research or area of application in the form of a term project.

Prerequisites[2]

ENGS 93 or comparable course in probability and statistics; previous programming experience with Matlab, C, S, R, Julia, or similar language. (MATH/COSC 71, ENGS 91, COSC 70/170 are examples for appropriate ways to fulfill the programming requirement.) We will use the R language for code discussions and assignments. R is open source, widely used in statistics, and relatively easy to learn. The prerequisites can be replaced by a permission from the instructor.

Course Goal and Objectives

After successfully completing this course, students should be able to understand, explain, choose, implement, and communicate concepts and techniques of Bayesian analyses relevant to their own research.

[1] Text copied from schedule of courses (accessed August 12 2022) and modified
[2] Text copied from schedule of courses (accessed August 12 2022) and modified

To achieve this goal, students will:

1. increase their understanding of theoretical foundation and computational approaches by reviewing peer-reviewed publications (often focusing on case studies), sections from textbooks, in-class activities, and problem sets,
2. learn how to choose, implement, and test key Bayesian techniques in problem sets and a term project,
3. improve their communication skills by class discussions, in-class presentations, and a written summary of a term project, and
4. learn how Bayesian analyses can influence real-world decisions (and back).

Teaching Methods

This class will be a mixture of lectures, student presentations, group discussions, and code reviews. Meetings typically start with a brief student-led review of the pre-reading materials, followed by instructor-led review of concepts and discussion. Students propose the topics of their term projects. This class is designed to be engaging and responsive to students' interests. Please reach out to the instructor with any suggestions on how this class can be improved.

Expectations of Students

This class will require your sustained attention. Students are expected to:

1. prepare for the meetings (e.g., by carefully reading and synthesizing the reading assignments and being prepared to present their synthesis in class),
2. actively contribute to the group discussions, and
3. prepare and submit the assignments in time.

The class is designed with the expectation that students spend roughly three times the lecture contact hours outside the class for readings and assignments.

Overview of Topics[3]

1. Why use Bayesian methods?
   a. Review of probability
   b. The Bayesian approach
      i. Links to decision-making (Bayes Risk, Loss function)
      ii. The likelihood function
      iii. The prior
      iv. The posterior
2. "Simple" approaches (when things seem or may even be easy)
   a. Analytical solutions / Kalman filter
   b. Precalibration
   c. Bayes Monte Carlo

[3] This is an initial outline. The focus can be refined based on student interests, progress, and current events.

    d. Markov Chain Monte Carlo
3. How to plan, document, and communicate Bayesian analyses?
    a. How to define the question?
    b. How to pick a (n initial) method?
    c. How to pitch a research idea?
    d. How to write a method section for a paper / a proposal?
    e. How to document and share your analyses?
4. What to do when simple approaches do not work?
    a. Detecting problems
        i. Lack of convergence
        ii. Misconvergence
        iii. Deep uncertainty
        iv. Poor priors
    b. Tackling the problems
        i. Poor priors
            1. Expert elicitation
            2. Probabilistic inversion
        ii. Deep uncertainty
            1. Communication and analysis
            2. Model selection
            3. Links to robust decision-making
            4. (IF WE HAVE TIME) Slow models
                a. Particle Filter
                b. Emulation
                c. Hybrid methods
                d. Global sensitivity analysis and factor prioritization

Grading

The overall course grade will be based on a weighted average of the grades for these components:

● Problem sets	40%
● Term Project Presentation	20%
● Written Term Project Report	40%

We adopt the "*Vikrant Vaze Grading Algorithm*"[4]: Your final grade will be decided based on your absolute as well as relative performance in the class, whichever is higher. Out of 100 total points, if you score at least min(90, Median + Standard Deviation) points, you are guaranteed an HP grade. If

[4] Personal communication from Vikrant Vaze

you score at least min(75, Median - Standard Deviation) points, you are guaranteed at least a P grade. Note that this is even more favorable to you than the standard grading on the curve."

Written assignments must be submitted via Canvas before the deadline to receive a full grade. Late submissions will receive a downgrading by 25% of the full grade for each day they are late. Requests for extended deadlines must be made via email 24 hours before the submission deadline with a submission of what has been achieved, thus far.

Draft Schedule (subject to adjustments based on student interests and progress)

Week	Week starting	Class 1	Class 2	Class 3	Assignment out	Assignment due
1	January 2, 2023	No Class	Introduction to the class	Bayesian Approach I		none
2	January 9, 2023	Bayesian Approach II	Picking a project	Setting up Computation	1	none
3	January 16, 2023	Analytical Solutions / Kalman	Precalibration /(Bayes) Monte Carlo	MCMC Part 1	2	1
4	January 23, 2023	MCMC Part 2	Bayesian Workflow	Bayesian Workflow	3	2
5	January 30, 2023	Students pitch project ideas	Writing a method section	Catching up / review	4	3
6	February 6, 2023	Convergence diagnostics	Checking Assumptions	Deep Uncertainty	5	4
7	February 13, 2023	Geeting Solid Priors	Links to Decision-Making	Links to Decision-Making	6	5
8	February 20, 2023	Model Choice	Emulation	Sensitivity analysis	7	6
9	February 27, 2023	Communication of results	Student Presentations	Student Presentations	8	7
10	March 6, 2023	Class Debriefing / Resarch links	No Class	No Class	none	8

Assignments

1. Problem Set: Review of Academic Integrity and Course Syllabus
2. Problem Set: Scripts / Documentation / Plots / Monte Carlo / Convergence / Seeds
3. Problem Set: Bayes Monte Carlo / Grid Methods
4. Problem Set: Markov Chain Monte Carlo
5. Problem Set: Project Pitch
6. Problem Set: Prior Predictive Checks / Probabilistic Inversion
7. Problem Set: Decision Analyses Links / Deep Uncertainty
8. Final Project Document

Problem sets cover a mix of analytical, computational, and communication tasks.

The term project addresses an inference problem that is (ideally directly) relevant to your own research. Please meet with the instructor in the office hours in the first two weeks to discuss your project ideas and to converge on your choice and plan. The project has to analyze data to address a research question using a Bayesian framework. Given the relatively short time available during the term, it can make sense to pick a problem that - at least initially - looks easy to you and that you hypothesize can be handled by the relatively straightforward methods covered in the first half of the class. In the project report, please discuss the limitations of your (potentially preliminary) analysis and avenues to improve.

You will pitch the project idea in class, submit a project pitch as a problem set, present your project to the class, and submit a written report including the used code and data (please see schedule and list of assignments above). The class project requires your attention and time commitment during the entire term.

Course Logistics

1. Homework and Case Study Submissions
   Homeworks will be assigned at the end of the week on the class Canvas page. You will have one week to complete the homework. Please submit on Canvas a pdf of your solutions along with a single R script and all source files necessary to reproduce your results.
2. Software and Web Resources
   a. R and RStudio
      Some familiarity with R is required for this course to follow the demonstrations and code discussions and to complete the assignments. Please use the links above to download and install the latest versions of R and RStudio for your preferred operating system. If you cannot use R locally, R is available on the Thayer Linux systems located in MacLean 210 and Cummings G13. Some helpful resources are listed below to help students get started or refreshed with using R.
      i. "An Introduction to R" at http://cran.r-project.org/doc/contrib/Lam-IntroductionToR_LHL.pdf
      ii. simpleR - Using R for Introductory Statistics" at http://cran.r-project.org/doc/contrib/Verzani-SimpleR.pdf
   b. GitHub
      Example problem sets and case studies are posted on the Class GitHub for students to use as guidelines. Students may use the class GitHub page to access supplementary class materials and extra resources for learning R.
   c. Jupyter Notebooks

Several Jupyter Notebook Lab Manuals are available on the Class GitHub page as extra resources for learning R and as additional exercises for applying the class material. Reviewing these notebooks and attempting the additional exercises is optional.

Course Materials

Course materials include meeting notes, peer-reviewed publications, preprints, and reports. Students should be able to access all materials through the Dartmouth library system (if the materials are behind a paywall) or legally and for free on the web (e.g., for governmental reports).

Textbooks

There is no need to *purchase* a textbook. We will use *excerpts* from books that are either open access (preferred) or available from the Dartmouth library. Examples include:

Applegate, P. J., & Keller, K. (Eds.). (2016). Risk analysis in the Earth Sciences: A Lab manual. 2nd edition. Leanpub. Open Source and free at: https://leanpub.com/raes

Clyde, M., Çetinkaya-Rundel, M., Rundel, C., Banks, D., Chai, C., & Huang, L. (2022). An Introduction to Bayesian Thinking. Retrieved from https://statswithr.github.io/book/ accessed 02/07/2022

D'Agostini, G. (2003). *Bayesian reasoning in data analysis: A critical introduction*. Singapore: World Scientific Publishing (available for loan / download at Dartmouth library)

Gelman, A., Carlin, J. B., Stern, H. S., Dunson, D. B., Vehtari, A., & Rubin, D. B. (2013). Bayesian data analysis, third edition (3rd ed.). Chapman & Hall/CRC. free academic pdf: http://www.stat.columbia.edu/~gelman/book/

Kurz, A. S. (2022). *Statistical Rethinking with brms, ggplot2, and the tidyverse*. Retrieved from https://bookdown.org/content/4857/

Kurz, A. S. (5 2022). Doing Bayesian data analysis in brms and the tidyverse (Version 1.0.0). Retrieved from https://bookdown.org/content/3686/

Grinstead, C. M., & Laurie Snell., J. (2003). *Introduction to Probability*. American Mathematical Society. Retrieved from https://math.dartmouth.edu/~prob/prob/prob.pdf accessed Nov 23 2022

Reed, P. M., Hadjimichael, A., Malek, K., Karimi, T., Vernon, C. R., Srikrishnan, V., Gupta, R. S., Gold, D. F., Lee, B., Keller, K., Rice, J. S., & Thurber, T. B. (2022). Addressing Uncertainty in MultiSector Dynamics Research. https://uc-ebook.org/

Current draft reading sequence (with projected timing[5])

Bold sources are required reading. The others are supplementary for (sometimes rather theoretical) background.

[5] Subject to change

What are and why use Bayesian methods? (weeks 1-2)

Applegate, P. J., & Keller, K. (Eds.). (2016). Risk analysis in the Earth Sciences: A Lab manual. 2nd edition. Leanpub. Open Source and free at: https://leanpub.com/raes (Chapter 1)

Budescu, D. V., Broomell, S. B., Lempert, R. J., & Keller, K. (2014). Aided and unaided decisions with imprecise probabilities in the domain of losses. *EURO Journal on Decision Processes*, *2*(1), 31–62. https://doi.org/10.1007/s40070-013-0023-4

Clyde, M., M. Çetinkaya-Rundel, C. Rundel, D. Banks, C. Chai, L. Huang. (2022). An Introduction to Bayesian Thinking. Retrieved from https://statswithr.github.io/book/ accessed 02/07/2022 (Chapter 1)

Freedman, D. (1997). Some Issues in the Foundation of Statistics. In B. C. van Fraassen (Ed.), Topics in the Foundation of Statistics (pp. 19–39). Springer Netherlands. https://doi.org/10.1007/978-94-015-8816-4_4

Jefferys, W. H., & Berger, J. O. (1992). Ockham's razor and Bayesian analysis. American Scientist, 80(1), 64–72. https://www.jstor.org/stable/pdf/29774559.pdf

Ruckert, K. L., Guan, Y., Bakker, A. M. R., Forest, C. E., & Keller, K. (2017). The effects of time-varying observation errors on semi-empirical sea-level projections. Climatic Change, 140(3-4), 349–360. https://doi.org/10.1007/s10584-016-1858-z

van de Schoot, R., Depaoli, S., King, R., Kramer, B., Märtens, K., Tadesse, M. G., Vannucci, M., Gelman, A., Veen, D., Willemsen, J., & Yau, C. (2021). Bayesian statistics and modelling. Nature Reviews Methods Primers, 1(1), 1–26. https://doi.org/10.1038/s43586-020-00001-2

"Simple" approaches (weeks 2-4)

Chen, Z., & Others. (2003). Bayesian filtering: From Kalman filters to particle filters, and beyond. *Statistics*, *182*(1), 1–69.

Jones, G. L., & Qin, Q. (2021). Markov chain Monte Carlo in practice. Annual Review of Public Health, 9(1), 557–578. https://doi.org/10.1146/annurev-statistics-040220-090158

D'Agostini, G. (2003). Bayesian reasoning in data analysis: A critical introduction. Singapore: World Scientific Publishing. (Chapter 6, an easy and elegant introduction).

Kalman, R. E. (1960). A New Approach to Linear Filtering and Prediction Problems. *Journal of Basic Engineering*, *82*(1), 35–45. https://doi.org/10.1115/1.3662552

Kalman Filter. (n.d.). Retrieved November 29, 2022, from https://en.wikipedia.org/wiki/Kalman_filter

Qian, S. S., Stow, C. A., & Borsuk, M. E. (2003). On Monte Carlo methods for Bayesian inference. Ecological Modelling, 159(2-3), 269–277.

Perkel, J. M. (2022). How to fix your scientific coding errors. *Nature*, *602*(7895), 172–173. https://doi.org/10.1038/d41586-022-00217-0

Sriver, R. L., Urban, N. M., Olson, R., & Keller, K. (2012). Toward a physically plausible upper bound of sea-level rise projections. Climatic Change, 115(3-4), 893–902. https://doi.org/10.1007/s10584-012-0610-6

Stark, P. B. (2018). Before reproducibility must come preproducibility. *Nature*, *557*(7707), 613. https://doi.org/10.1038/d41586-018-05256-0

Reed, P. M., Hadjimichael, A., Malek, K., Karimi, T., Vernon, C. R., Srikrishnan, V., Gupta, R. S., Gold, D. F., Lee, B., Keller, K., Rice, J. S., & Thurber, T. B. (2022). Addressing Uncertainty in MultiSector Dynamics Research. https://uc-ebook.org/ (Chapter 2 and Appendix A)

Ruckert, K. L., Guan, Y., Bakker, A. M. R., Forest, C. E., & Keller, K. (2017). The effects of time-varying observation errors on semi-empirical sea-level projections. Climatic Change, 140(3-4), 349–360. https://doi.org/10.1007/s10584-016-1858-z

Ruckert, K. L., Shaffer, G., Pollard, D., Guan, Y., Wong, T. E., Forest, C. E., & Keller, K. (2017). Assessing the Impact of Retreat Mechanisms in a Simple Antarctic Ice Sheet Model Using Bayesian Calibration. PloS One, 12(1), e0170052. https://doi.org/10.1371/journal.pone.0170052

Ruckert, K. L., Wong, T. E., Guan, Y., Haran, M., & Applegate, P. J. (n.d.). A Calibration Problem and Markov Chain Monte Carlo. In V. Srikrishnan & K. Keller (Eds.), *Advanced Risk Analysis in the Earth Sciences*.

Ruckert, K. L., Wong, T. E., Guan, Y., & Haran, M. (in prep). Applying Markov Chain Monte Carlo to Sea-Level Data. In V. Srikrishnan & K. Keller (Eds.), *Advanced Risk Analysis in the Earth Sciences*.

Ruckert, K. L., Wong, T. E., Lee, B. S., Guan, Y., & Haran, M. (in prep). Bayesian Inference and Markov Chain Monte Carlo Basics. In V. Srikrishnan & K. Keller (Eds.), *Advanced Risk Analysis in the Earth Sciences*.

Sunnåker, M., Busetto, A. G., Numminen, E., Corander, J., Foll, M., & Dessimoz, C. (2013). Approximate Bayesian computation. PLoS Computational Biology, 9(1), e1002803. https://doi.org/10.1371/journal.pcbi.1002803

How to plan, document, and communicate Bayesian analyses? (week 5)

License, C.-B.-4 0. (n.d.). *introduction-to-github: Get started using GitHub in less than an hour*. Github. Retrieved from https://github.com/skills/introduction-to-github

Doss-Gollin, J., & Keller, K. (2022). A subjective Bayesian framework for synthesizing deep uncertainties in climate risk management. https://doi.org/10.1002/essoar.10511798.1

Soetaert, K., & Petzoldt, T. (2010). Inverse Modelling, Sensitivity and Monte Carlo Analysis in R Using Package FME. *Journal of Statistical Software*, *33*, 1–28. https://doi.org/10.18637/jss.v033.i03

Boersch-Supan, P. H., Ryan, S. J., & Johnson, L. R. (2017). deBInfer: Bayesian inference for dynamical models of biological systems in R. *Methods in Ecology and Evolution / British Ecological Society*, *8*(4), 511–518. https://doi.org/10.1111/2041-210x.12679

Gelman, A., Vehtari, A., Simpson, D., Margossian, C. C., Carpenter, B., Yao, Y., Kennedy, L., Gabry, J., Bürkner, P.-C., & Modrák, M. (2020). Bayesian Workflow. In arXiv [stat.ME]. arXiv. http://arxiv.org/abs/2011.01808 (**excerpts..**)

Schoot, R. van de, van de Schoot, R., Veen, D., Smeets, L., Winter, S. D., & Depaoli, S. (2020). A Tutorial on Using The Wambs Checklist to Avoid The Misuse of Bayesian Statistics. Small Sample Size Solutions. https://doi.org/10.4324/9780429273872-4

Depaoli, S., & van de Schoot, R. (2017). Improving transparency and replication in Bayesian statistics: The WAMBS-Checklist. *Psychological Methods*, *22*(2), 240–261. https://doi.org/10.1037/met0000065

Kruschke, J. K. (2021). Bayesian Analysis Reporting Guidelines. *Nature Human Behaviour*, *5*(10), 1282–1291. https://doi.org/10.1038/s41562-021-01177-7

Detecting and fixing problems (weeks 6-8)

Cooke, R. M., Nauta, M., Havelaar, A. H., & van der Fels, I. (2006). Probabilistic inversion for chicken processing lines. Reliability Engineering & System Safety, 91(10–11), 1364–1372. https://doi.org/10.1016/j.ress.2005.11.054

Francom, D., & Sansó, B. (2020). BASS: An R package for fitting and performing sensitivity analysis of Bayesian adaptive spline surfaces. Journal of Statistical Software, 94(8). https://doi.org/10.18637/jss.v094.i08

Fuller, R. W., Wong, T. E., & Keller, K. (2017). Probabilistic inversion of expert assessments to inform projections about Antarctic ice sheet responses. PloS One, 12(12), e0190115. https://doi.org/10.1371/journal.pone.0190115

Gabry, J., Simpson, D., Vehtari, A., Betancourt, M., & Gelman, A. (2019). Visualization in Bayesian workflow. Journal of the Royal Statistical Society. Series A, , 182(2), 389–402. https://doi.org/10.1111/rssa.12378

Lee, B. S., Haran, M., Fuller, R. W., Pollard, D., & Keller, K. (2020). A fast particle-based approach for calibrating a 3-D model of the Antarctic ice sheet. The Annals of Applied Statistics, 14(2), 605–634. https://doi.org/10.1214/19-AOAS1305

Olson, R., Sriver, R., Chang, W., Haran, M., Urban, N. M., & Keller, K. (2013). What is the effect of unresolved internal climate variability on climate sensitivity estimates? Journal of Geophysical Research, D: Atmospheres, 118(10), 4348–4358. https://doi.org/10.1002/jgrd.50390

Srikrishnan, V., & Keller, K. (2021). Small increases in agent-based model complexity can result in large increases in required calibration data. *Environmental Modelling & Software*, *138*, 104978. https://doi.org/10.1016/j.envsoft.2021.104978

Lemoine, N. P. (2019). Moving beyond noninformative priors: why and how to choose weakly informative priors in Bayesian analyses. Oikos , 128(7), 912–928. https://doi.org/10.1111/oik.05985

Dealing with deep uncertainty and informing decision-making (weeks 8-10)

Clyde, M., Çetinkaya-Rundel, M., Rundel, C., Banks, D., Chai, C., & Huang, L. (2022). An Introduction to Bayesian Thinking. Retrieved from https://statswithr.github.io/book/ accessed 02/07/2022 (Chapter 3)

Ellsberg, D. (1961). Risk, Ambiguity, and the Savage Axioms. *The Quarterly Journal of Economics*, *75*(4), 643–669. https://doi.org/10.2307/1884324

Keller, K., Helgeson, C., & Srikrishnan, V. (2021). Climate Risk Management. *Annual Review of Earth and Planetary Sciences*, *49*, 95–116. https://doi.org/10.1146/annurev-earth-080320-055847

Srikrishnan, V., Guan, Y., Tol, R. S. J., & Keller, K. (2022). Probabilistic projections of baseline twenty-first century CO_2 emissions using a simple calibrated integrated assessment model. *Climatic Change*, *170*(3-4), 37. https://doi.org/10.1007/s10584-021-03279-7

Wagenmakers, E.-J., Sarafoglou, A., & Aczel, B. (2022). One statistical analysis must not rule them all. *Nature*, *605*(7910), 423–425. https://doi.org/10.1038/d41586-022-01332-8

Wong, T. E., Klufas, A., Srikrishnan, V., & Keller, K. (2018). Neglecting model structural uncertainty underestimates upper tails of flood hazard. Environmental Research Letters: ERL [Web Site], 13(7), 074019. https://doi.org/10.1088/1748-9326/aacb3d

Dormann, C. F., Calabrese, J. M., Guillera-Arroita, G., Matechou, E., Bahn, V., Bartoń, K., et al. (2018). Model averaging in ecology: a review of Bayesian, information-theoretic, and tactical approaches for predictive inference. Ecological Monographs, 88(4), 485–504. https://doi.org/10.1002/ecm.1309

Höge, M., Guthke, A., & Nowak, W. (2019). The hydrologist's guide to Bayesian model selection, averaging and combination. *Journal of Hydrology*, *572*, 96–107. https://doi.org/10.1016/j.jhydrol.2019.01.072

Technology Use in the Classroom

We do analyze and discuss codes in class. Having a laptop or tablet simplifies this (but is not required). We want to maximize the time during class for discussions and group activities. Note-taking on electronic devices can be useful (and is acceptable in class), but it can also distract from the discussion. Use of cell-phones for calls or texting is only acceptable in case of an emergency. If you need to answer a phone call in case of an emergency, please step outside the classroom.

Class Climate and Inclusivity

We will discuss questions that for some are associated with strong emotions and opinions. We will read and discuss sources from a wide range of authors. These sources are selected to sample a wide range of diverse perspectives. However, it seems likely that important perspectives are missing.

This class strives to provide a respectful, inclusive, and civil space for all. Instruments designed to help achieve these objectives include:

1. Please introduce yourself to all members of this class with your names and preferred pronouns.

2. Please reach out to the instructor if your performance and ability to learn is impacted by factors outside of the classroom (including financial challenges). The instructor is here to help as much as possible. Feedback can also be anonymous (including a note under the office door of the instructor).
3. We all are continuously learning about how to ensure an inclusive environment and how to discuss contentious and emotional subjects. Please provide feedback if something makes you feel uncomfortable.

Attendance Policy

There are no credits for just attending the class. Students do not need to explain if and when they miss a class. We can discuss what you missed in the office hours. Please let me know if you expect a prolonged absence.

Canvas

Course communication, assignments, submissions of written materials will be handled through the course Canvas site.

Students' Consent to recording of course meetings and office hours that are open to multiple students[6]

By enrolling in this course,

a) I affirm my understanding that the instructor may record meetings of this course and any associated meetings open to multiple students and the instructor, including but not limited to scheduled and ad hoc office hours and other consultations, within any digital platform, including those used to offer remote instruction for this course.

b) I further affirm that the instructor owns the copyright to their instructional materials, of which these recordings constitute a part, and my distribution of any of these recordings in whole or in part to any person or entity other than other members of the class without prior written consent of the instructor may be subject to discipline by Dartmouth up to and including separation from Dartmouth.

(2) Requirement of consent to one-on-one recordings

By enrolling in this course, I hereby affirm that I will not make a recording in any medium of any one-on-one meeting with the instructor or another member of the class or group of members of the class without obtaining the prior written consent of all those participating, and I understand that if I violate this prohibition, I will be subject to discipline by Dartmouth up to

[6] This section is taken verbatim from: https://dcal.dartmouth.edu/resources/course-design-preparation/syllabus-guide accessed June 27 2022. The "I" in this section refers to students.

and including separation from Dartmouth, as well as any other civil or criminal penalties under applicable law. I understand that an exception to this consent applies to accommodations approved by SAS for a student's disability, and that one or more students in a class may record class lectures, discussions, lab sessions, and review sessions and take pictures of essential information, and/or be provided class notes for personal study use only.

Academic Integrity

Please review the

- Dartmouth academic honor principle,
- the information at Office of Community Standards & Accountability, and
- information on sources and citations provided by the Institute for writing and rhetoric.

You can discuss questions, approaches, and even codes with others (e.g., your fellow students). However, your submitted work must be your own. For example, copying code and/or text from someone else without proper attribution is not acceptable.

Student Accessibility and Accommodations[7]

Students requesting disability-related accommodations and services for this course are required to register with Student Accessibility Services (SAS; Getting Started with SAS webpage; student.accessibility.services@dartmouth.edu; 1-603-646-9900) and to request that an accommodation email be sent to me in advance of the need for an accommodation. Then, students should schedule a follow-up meeting with me to determine relevant details such as what role SAS or its Testing Center may play in accommodation implementation. This process works best for everyone when completed as early in the quarter as possible. If students have questions about whether they are eligible for accommodations or have concerns about the implementation of their accommodations, they should contact the SAS office. All inquiries and discussions will remain confidential.

Religious Observances[8]

Some students may wish to take part in religious observances that occur during this academic term. If you have a religious observance that conflicts with your participation in the course, please meet with me before the end of the second week of the term to discuss appropriate accommodations.

Mental Health and Wellbeing[9]

The academic environment is challenging, our terms are intensive, and classes are not the only demanding part of your life. There are a number of resources available to you on campus to

[7] Source: https://dcal.dartmouth.edu/resources/course-design-preparation/syllabus-guide, accessed June 28 2022
[8] Source: https://dcal.dartmouth.edu/resources/course-design-preparation/syllabus-guide, accessed June 28 2022
[9] Source: https://dcal.dartmouth.edu/resources/course-design-preparation/syllabus-guide, accessed June 28 2022

support your wellness, including: the Counseling Center, which allows you to book triage appointments online, the Student Wellness Center which offers wellness check-ins, and your undergraduate dean. The student-led Dartmouth Student Mental Health Union and their peer support program may be helpful if you would like to speak to a trained fellow student support listener. If you need immediate assistance, please contact the counselor on-call at (603) 646-9442 at any time. Please make me aware of anything that will hinder your success in this course.

Title IX[10]

At Dartmouth, we value integrity, responsibility, and respect for the rights and interests of others, all central to our Principles of Community. We are dedicated to establishing and maintaining a safe and inclusive campus where all have equal access to the educational and employment opportunities Dartmouth offers. We strive to promote an environment of sexual respect, safety, and well-being. In its policies and standards, Dartmouth demonstrates unequivocally that sexual assault, gender-based harassment, domestic violence, dating violence, and stalking are not tolerated in our community. The Sexual Respect Website (https://sexual-respect.dartmouth.edu) at Dartmouth provides a wealth of information on your rights with regard to sexual respect and resources that are available to all in our community.

Please note that, as a faculty member, I am obligated to share disclosures regarding conduct under Title IX with Dartmouth's Title IX Coordinator. Confidential resources are also available, and include licensed medical or counseling professionals (e.g., a licensed psychologist), staff members of organizations recognized as rape crisis centers under state law (such as WISE), and ordained clergy (see https://dartgo.org/titleix_resources). Should you have any questions, please feel free to contact Dartmouth's Title IX Coordinator or the Deputy Title IX Coordinator for the Guarini School. Their contact information can be found on the sexual respect website at: https://sexual-respect.dartmouth.edu.

[10] Text copied and edited from https://dcal.dartmouth.edu/resources/course-design-preparation/syllabus-guide, accessed June 28 2022