

Logic & Scientific Reasoning

PHIL313Q | Fall 2022

Lecture (in-person)

Tuesday & Thursday | 9:30 – 11:00 AM | George Sanchez Building (SZB) 2.802

Discussion Section (in-person)

Monday | 9:00 – 10:00 AM | Waggener Hall (WAG) 210

Instructor

Alex Rausch | aprausch@utexas.edu | Virtual Office Hours by Request

Teaching Assistant

TBD

Course Description

This course is a philosophical introduction to formal logic and probability theory – their methods, applications, and foundations. In the first half of the course, we'll study the syntax and semantics of sentential and predicate logic. This involves constructing mathematical structures that formally represent, to some degree of abstraction, the meanings of sentences in natural languages, such as English. In the second half of the course, we'll study different kinds of probability theories and the laws that govern them. Learning about the core principles of deductive and inductive logic will strengthen our ability to think critically and with less susceptibility to fallacies. Succeeding in this course requires hard work, including an average of 25 pages of reading for each lecture day, attendance in weekly discussion sections, and individually completing weekly problem sets, but no special talent or background knowledge is required. *This course is open only to Plan II students.*

Quantitative Reasoning Flag

This course carries the Quantitative Reasoning flag. Quantitative Reasoning courses are designed to equip you with skills that are necessary for understanding the types of quantitative arguments you will regularly encounter in your adult and professional life. You should therefore expect a substantial portion of your grade to come from your use of quantitative skills to analyze real-world problems.

Philosophy Major

This course satisfies the three hours of symbolic logic required for the philosophy major. Only one of the following may be counted towards the major: Philosophy 313, 313K, 313Q. Philosophy 313Q and Tutorial Course 310 may not both be counted.

Texts

The texts for the course are:

- *The Logic Book (6th Edition)*, by Bergmann, Moor & Nelson
- *An Introduction to Probability & Inductive Logic*, by Ian Hacking

Both will be available at the University Co-op. Contact me if you cannot afford a copy.

You must have access to both textbooks, whether physical or electronic, during all lectures and discussion sections.

Course Requirements

1. Daily Readings
 - Each lecture is accompanied by a reading of approximately 25 pages.
2. Weekly Problem Sets
 - Problem sets designed to take between 3-5 hours to complete are due at the start of (almost) every Tuesday lecture.
3. Exams
 - There will be two in-class exams. These exams will cover the same material as is covered in the weekly problem sets. You may bring a single sheet of paper with double-sided, hand-written notes to use for each exam.
4. Class Participation
 - Primarily, attendance of and participation in the weekly discussion section.

There is no final exam for this course.

Late work will not be accepted.

All turned-in work must be completed individually.

Grade Distribution

- 10 Weekly Problem Sets: 5% each (for a total of 50%)
- 2 Exams: 23% each (for a total of 46%)
- Participation: 4%

Schedule of Events

Date	Topic	Reading
Tue 8/23	Introduction to the Course	
Thu 8/25	Concepts of Deductive Logic	TLB 1.1–1.3, PIL 1
Mon 8/29	Discussion Section	
Tue 8/30	Practice Problem Set Due Sentential Logic (SL) Syntax	TLB 2.1–2.2, 2.4, p. 54
Thu 9/1	Sentential Logic (SL) Semantics	TLB 3.1–3.5
Mon 9/5	Labor Day, No Class	
Tue 9/6	Problem Set 1 Due Sentential Derivations (SD)	TLB 5.1

Thu 9/8	More Sentential Derivations (SD+)	TLB 5.3, 5.4
Mon 9/12	Discussion Section	
Tue 9/13	Problem Set 2 Due Predicate Logic (SL) Syntax	TLB 7.1–7.3
Thur 9/15	Predicate Logic (PL) Semantics	TLB 7.5 (stop at p. 319), 8.1 (stop at p. 337), 8.2–8.4
Mon 9/19	Discussion Section	
Tue 9/20	Problem Set 3 Due Predicate Derivations (PD)	TLB 10.1–10.2
Thur 9/22	More Predicate Derivations (PD+)	TLB 10.3
Mon 9/26	Discussion Section	
Tue 9/27	Problem Set 4 Due In-Class Review	
Thu 9/29	In-Class Exam #1	
Mon 10/3	Discussion Section	
Tue 10/4	Concepts of Inductive Logic	PIL 2 & 3
Thu 10/6	Calculating Probabilities I	PIL 4 & 5
Mon 10/10	Discussion Section	
Tue 10/11	Problem Set 5 Due Calculating Probabilities II	PIL 6 & 7
Thu 10/13	Decision Theory I	PIL 8
Mon 10/17	Discussion Section	
Tue 10/18	Problem Set 6 Due Decision Theory II	PIL 9
Thu 10/20	Decision Theory III	PIL 10
Mon 10/24	Discussion Section	
Tue 10/25	Problem Set 7 Due Kinds of Probability	PIL 11 & 12
Thu 10/27	Probability as Measure of Belief I	PIL 13 & 14

Mon 10/31	Discussion Section	
Tue 11/1	Problem Set 8 Due Probability as Measure of Belief II	PIL 15
Thu 11/3	Probability as Frequency I	PIL 16 & 17
Mon 11/7	Discussion Section	
Tue 11/8	Problem Set 9 Due Probability as Frequency II	PIL 18 & 19
Thu 11/10	Problem of Induction	PIL 20–22
Mon 11/14	Discussion Section	
Tue 11/15	Problem Set 10 Due In-Class Review	
Thu 11/17	In-Class Exam #2	
Mon 11/21 – Thu 11/24	Fall Break, No Class	
Mon 11/28	Discussion Section	
Tue 11/29	Intermediate Topic #1*	TBD
Thur 12/1	Intermediate Topic #2*	TBD
Mon 12/5	Discussion Section	

*Examples of intermediate topics include:

- Meta-theory of sentential and predicate logic, soundness & completeness
- Modal logic, tense logic, epistemic logic, doxastic logic
- Second-order logic, Kaplan-Geach sentences, ontological commitment, higher-order logic
- Non-classical logics, vagueness, multi-valued logics, paraconsistency
- Application to linguistics: truth-conditions, compositionality, intensional logic

Zero Tolerance of Cheating & Plagiarism

Any form of cheating will immediately earn you a failing grade for the entire course. By remaining enrolled, you consent to this policy.

University Resources for Students

- [Services for Students with Disabilities](#) (SSD)
The university is committed to creating an accessible and inclusive learning environment consistent with university policy and federal and state law. Please let me know if you

experience any barriers to learning so I can work with you to ensure you have equal opportunity to participate fully in this course. If you are a student with a disability, or think you may have a disability, and need accommodations please contact Disability and Access (D&A). Please refer to D&A's website for contact and more information: <http://diversity.utexas.edu/disability/>. If you are already registered with D&A , please deliver your Accommodation Letter to me as early as possible in the semester so we can discuss your approved accommodations and needs in this course.

- [Counseling and Mental Health Center](#) (CMHC)
All of us benefit from support during times of struggle. Know you are not alone. If you or anyone you know is experiencing symptoms of stress, anxiety, depression, academic concerns, loneliness, difficulty sleeping, or any other concern impacting your wellbeing – you are strongly encouraged to connect with CMHC. The Counseling and Mental Health Center provides a wide variety of mental health services to all UT students including crisis services, counseling services with immediate support and well-being resources. Additionally, CARE Counselors are located within the academic schools and colleges. These counselors get to know the concerns that are unique to their college's students. For more information on CMHC, visit cmhc.utexas.edu or call 512-471-3515.
- [University Health Services](#) (UHS)
Your physical health and wellness are a priority. University Health Services is an on-campus high-quality medical facility providing care to all UT students. Services offered by UHS include general medicine, urgent care, a 24/7 nurse advice line, women's health, sports medicine, physical therapy, lab and radiology services, COVID-19 testing and vaccinations and much more. For additional information, visit healthyhorns.utexas.edu or call 512-471-4955.
- [Sanger Learning Center](#)
Did you know that more than one-third of UT undergraduate students use the Sanger Learning Center each year to improve their academic performance? All students are welcome to take advantage of Sanger Center's classes and workshops, private learning specialist appointments, peer academic coaching, and tutoring for more than 70 courses in 15 different subject areas. For more information, please visit <https://ugs.utexas.edu/slc> or call 512-471-3614 (JES A332).
- [Student Emergency Services](#) (SES)
Student Emergency Services in the Office of the Dean of Students helps students and their families during difficult or emergency situations. Assistance includes outreach, advocacy, intervention, support, and referrals to relevant campus and community resources. If you need to be absent from class due to a family emergency, medical or mental health concern, or academic difficulty due to crisis or an emergency situation, you can work with Student Emergency Services. SES will document your situation and notify your professors. Additional information is available at <https://deanofstudents.utexas.edu/emergency/> or by calling 512-471-5017.

Sexual Misconduct

Beginning January 1, 2020, Texas Senate Bill 212 requires all employees of Texas

universities, including faculty, report any information to the Title IX Office regarding sexual harassment, sexual assault, dating violence and stalking that is disclosed to them. Texas law requires that all employees who witness or receive any information of this type (including, but not limited to, writing assignments, class discussions, or one-on-one conversations) must be reported. If you would like to speak with someone who can provide support or remedies without making an official report to the university, please email advocate@austin.utexas.edu. For more information about reporting options and resources, visit <http://www.titleix.utexas.edu/>, contact the Title IX Office via email at titleix@austin.utexas.edu, or call 512-471-0419. Although graduate teaching and research assistants are not subject to Texas Senate Bill 212, they are still mandatory reporters under Federal Title IX laws and are required to report a wide range of behaviors we refer to as sexual misconduct, including the types of sexual misconduct covered under Texas Senate Bill 212. The Title IX office has developed supportive ways to respond to a survivor and compiled campus resources to support survivors.

Diversity, Equity, and Inclusion

It is my intent that students from all diverse backgrounds and perspectives be well served by this course, that students' learning needs be addressed, and that the diversity that students bring to this class can be comfortably expressed and be viewed as a resource, strength and benefit to all students. Please come to me at any time with any concerns.

Religious Observances

A student who misses classes or other required activities, including examinations, for the observance of a religious holy day should inform the instructor as far in advance of the absence as possible so that arrangements can be made to complete an assignment within a reasonable period after the absence. A reasonable accommodation does not include substantial modification to academic standards, or adjustments of requirements essential to any program of instruction. Students and instructors who have questions or concerns about academic accommodations for religious observance or religious beliefs may contact the [Office for Inclusion and Equity](#). The University does not maintain a list of religious holy days.

Names & Pronouns

Class rosters are provided to the instructor with the student's chosen (not legal) name, if you have provided one. If you wish to provide or update a chosen name, that [can be done easily at this page](#), and you can [add your pronouns to Canvas](#).