

PHIL 5209: Mathematical Methods for Philosophy (Fall 2021, 4 units)

August 20, 2021

Teaching Staff, Meeting Times, and Communication

Instructor: Prof. Samuel C. Fletcher (scfletch@umn.edu). Preferred address in person and by email: “Prof. Fletcher” (he/him/his).

Lectures: Tu/Th 1:00–2:15 in Heller 731

Discussion Section: Mo 11:15–12:05 in Heller 731

Office Hours: Mo/Tu 2:30–3:30, and by appointment in Heller 754 or via Zoom

Course Website: <https://canvas.umn.edu/courses/265713>. Please check Canvas often for course updates.

Timely Communication: Outside of class meeting times and office hours, I prefer that you contact me via Canvas Inbox or email, and will endeavor to respond within two business days. I expect the same of any email or Canvas messages to you.

Course Requirements

Prerequisites: Students are expected to have taken a course or have some background in mathematics, logic, or the mathematical sciences involving mathematical proof or argumentation.

Required Texts: All three of the following texts will be available at the bookstore:

- M. G. Bulmer, *Principles of Statistics*, New York: Dover, 1979.
- David Papineau, *Philosophical Devices: Proofs, Probabilities, Possibilities, and Sets*, Oxford: OUP, 2012.
- Eric Steinhart, *More Precisely: The Math You Need to Do Philosophy*, 2nd ed., Peterborough, ON: Broadview, 2018.

Other Required Materials: Please bring to every lecture and discussion section paper and either a pencil or a pen in blue or black ink.

Description and Objectives

Mathematical methods are increasingly used not just in logic and the philosophy of mathematics, but also in metaphysics, epistemology, philosophy of language, philosophy of mind, philosophy of science, and even in moral and political philosophy and the philosophy of religion. This course introduces some of these methods, such as sets, graphs, automata, and probability and decision theory, explicitly and through example applications. By the end of the semester, students will:

1. be familiar with enough with some of the mathematical methods used in philosophy to analyze and evaluate particular uses thereof in the research literature;
2. have the skills to apply some of these methods to philosophical problems; and
3. understand some of the strengths and limitations of particular formal methods and tools.

Instructional Time and Student Effort

There will be 200 minutes of instructional time per week, 150 of which will be in lecture and 50 of which will be in discussion section. In lectures, I will introduce new concepts and methods using the classroom whiteboard and via class-wide Q&A. In discussion sections, students will work in small groups on problems available on Canvas and representative of those on a forthcoming homework assignment. They will present their solutions to each other, and I will answer questions about them and lecture material. I will expect students to have reviewed the posted discussion section questions ahead of time.

You should expect to spend, on average, about 400 minutes per week completing reading and class assignments and practicing methods. In any given week, you may spend more or less than this. Spending more or less time does not necessarily indicate that you are achieving less or more, respectively.

Assessment

Basis for Evaluation

Homework (60%) There will be 12 homework assignments due at the beginning of certain Tuesday lectures, each worth 5% of your grade. These will be posted on the course Canvas site. You may submit your assignment on paper or digitally through Canvas. Half of the points for each homework problem will be awarded for completion, and half for correctness (with partial credit possible). You may discuss the homework problems with your classmates but if you do, you should indicate with whom on your submitted assignment. In any case, the document you turn in should be your own. I will not accept homework submitted late.

Class Presentations (40%) Each student will research and present on two topics or journal articles in philosophy that use mathematical methods. The topics should be related

to those covered in lecture; I will provide examples, but students can propose their own. I will require all students to meet with me twice to select and then develop their project. The first presentation will be due mid-semester, submitted as a recording to our course Canvas site, and should be on a topic related to the unit on sets, relations, and infinity. Instructions for recording and submitting this assignment are available on the assignment's Canvas page. The second will be due during our finals period, presented in person, and should be on a topic related to the units on probability, decision and game theory, or statistics and causality. Each presentation will be worth 20% of your final grade, inclusive of the progress during the development meetings.

Understanding Your Letter Grade

How to Compute Your Letter Grade				
	90 > B+ ≥ 87	80 > C+ ≥ 77	70 > D+ ≥ 67	
A ≥ 93	87 > B ≥ 83	77 > C ≥ 73	67 > D ≥ 63	F < 60
93 > A- ≥ 90	83 > B- ≥ 80	73 > C- ≥ 70	63 > D- ≥ 60	

Grades in the following ranges represent the following corresponding levels of achievement relative to the level necessary to meet course requirements:

- A:** Outstanding.
- B:** Significantly above.
- C:** Adequate in every respect.
- D:** Worthy of credit despite not fully meeting course requirements.
- F:** Not meeting enough course requirements to be deserving of credit.

Students taking this course “pass/fail” will receive an “S,” representing satisfactory achievement, for any standard final letter grade of “C-” or higher that he or she would have been assigned. Such students will receive an “N,” representing unsatisfactory achievement, for any standard final letter grade of “D+” or lower that he or she would have been assigned.

For additional information about University policies about grading and transcripts, please refer to: <http://policy.umn.edu/education/gradingtranscripts>.

Policies

Student Conduct Code

The University seeks an environment that promotes academic achievement and integrity, that is protective of free inquiry, and that serves the educational mission of the University. Similarly, the University seeks a community that is free from violence, threats, and intimidation; that is respectful of the rights, opportunities, and welfare of students, faculty, staff, and guests of the University; and that does not threaten the physical or mental health or safety of members of the University community.

As a student at the University you are expected adhere to the Board of Regents' Student Conduct Code. Note that the conduct code specifically addresses disruptive classroom conduct, which means “engaging in behavior that substantially or repeatedly interrupts either

the instructor's ability to teach or student learning. The classroom extends to any setting where a student is engaged in work toward academic credit or satisfaction of program-based requirements or related activities." The conduct code includes adherence to University COVID policies, such as wearing a face covering while indoors, when such policies are in effect.

Use of Personal Electronic Devices in the Classroom

The University establishes the right of each faculty member to determine if and how personal electronic devices are allowed to be used in the classroom. In this class, the use of laptops, tablets, and other electronic devices is permitted as long as it would not reasonably be a distraction to others. Reasonable distractions include movies, games, and social media. Students violating this policy will be asked to put their offending device away for the rest of the class session. Using personal electronic devices in the classroom setting, especially in these ways, can hinder instruction and learning, not only for the student using the device but also for other students in the class.

Scholastic Dishonesty

You are expected to do your own academic work and cite sources as necessary. Failing to do so is scholastic dishonesty. According to the student conduct code, "scholastic dishonesty" includes: plagiarizing; cheating on assignments or examinations; engaging in unauthorized collaboration on academic work; taking, acquiring, or using test materials without faculty permission; submitting false or incomplete records of academic achievement; acting alone or in cooperation with another to falsify records or to obtain dishonestly grades, honors, awards, or professional endorsement; altering, forging, or misusing a University academic record; or fabricating or falsifying data, research procedures, or data analysis. If it is determined that a student has cheated, he or she may be given an "F" or an "N" for the course, and may face additional sanctions from the University. For additional information, please see the UMN policy library.

The Office for Student Conduct and Academic Integrity has compiled a useful list of Frequently Asked Questions pertaining to scholastic dishonesty. If you have additional questions, please clarify with your instructor for the course.

Make-up Work for Legitimate Absences

Students will not be penalized for absence during the semester due to unavoidable or legitimate circumstances. Such circumstances include illness (inclusive of dependents), medical conditions related to pregnancy, participation in intercollegiate athletic events, subpoenas, jury duty, military service, bereavement, religious observances, and participation in formal University system governance. Such circumstances do not include voting in local, state, or national elections. For complete information, please see the UMN policy library.

Under such legitimate circumstances leading a student to be absent for any graded assignment, that student must contact me about it at least two weeks in advance, or as soon

as possible if the circumstances are known later, to schedule a make-up assignment or an extension on the assignment deadline, as I deem appropriate.

Appropriate Student Use of Class Notes and Course Materials

Taking notes is a means of recording information but more importantly of personally absorbing and integrating the educational experience. However, broadly disseminating class notes beyond the classroom community or accepting compensation for taking and distributing classroom notes undermines instructor interests in their intellectual work product while not substantially furthering instructor and student interests in effective learning. Such actions violate shared norms and standards of the academic community. For additional information, please see the UMN policy library.

Sexual Harassment

The University prohibits sexual misconduct, and encourages anyone experiencing sexual misconduct to access resources for personal support and reporting. If you want to speak confidentially with someone about an experience of sexual misconduct, please contact your campus resources including the Aurora Center, Boynton Mental Health or Student Counseling Services. If you want to report sexual misconduct, or have questions about the University's policies and procedures related to sexual misconduct, please contact your campus Title IX office or relevant policy contacts.

Instructors are required to share information they learn about possible sexual misconduct with the campus Title IX office that addresses these concerns. This allows a Title IX staff member to reach out to those who have experienced sexual misconduct to provide information about personal support resources and options for investigation. You may talk to instructors about concerns related to sexual misconduct, and they will provide support and keep the information you share private to the extent possible given their University role.

For additional information, please consult the Board of Regents' policy on the matter.

Equity, Diversity, Equal Opportunity, and Affirmative Action

The University provides equal access to and opportunity in its programs and facilities, without regard to race, color, creed, religion, national origin, gender, age, marital status, disability, public assistance status, veteran status, sexual orientation, gender identity, or gender expression. To this effect, please notify me if you have a preferred name or pronoun not indicated in your official enrollment data. For more information, please consult the Board of Regents' policy on the matter.

Disability Accommodations

The University of Minnesota is committed to providing equitable access to learning opportunities for all students. The Disability Resource Center (DRC) is the campus office that collaborates with students who have disabilities to provide and/or arrange reasonable accommodations. If you have, or think you may have, a disability (e.g., mental health, attentional,

learning, chronic health, sensory, or physical), please contact the DRC at 612-626-1333 to arrange a confidential discussion regarding equitable access and reasonable accommodations.

Students with short-term disabilities, such as a broken arm, can often work with instructors to minimize classroom barriers. In situations where additional assistance is needed, students should contact the DRC as noted above. If you are registered with the DRC and have a disability accommodation letter dated for this semester or this year, please contact me as early in the semester as possible to review how the accommodations will be applied in the course. If you are registered with the DRC and have questions or concerns about your accommodations, please contact your access consultant or disability specialist. For more information, please see the DRC website.

Mental Health and Stress Management

As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance and may reduce your ability to participate in daily activities. University of Minnesota services are available to assist you. You can learn more about the broad range of confidential mental health services available on campus via the Student Mental Health Website.

Academic Freedom and Responsibility

Academic freedom is a cornerstone of the University. Within the scope and content of the course as I have defined it, this includes the freedom to discuss relevant matters in the classroom. Along with this freedom comes responsibility. Students are encouraged to develop the capacity for critical judgment and to engage in a sustained and independent search for truth. Students are free to take reasoned exception to the views offered in any course of study, but they are responsible for learning the content of any course of study for which they are enrolled. Reports of concerns about academic freedom are taken seriously, and there are individuals and offices available for help, including me, the Philosophy Department Chair Prof. Peter Hanks (pwhanks@umn.edu), your adviser, or College of Liberal Arts Associate Dean for Arts and Humanities Josephine Lee (jolee@umn.edu).

Tentative Course Schedule

As the section title indicates, the course schedule is open to (reasonable) modification in light of the class's progress. Unless otherwise indicated, all readings are from *Principles of Statistics* (PS), *Philosophical Devices* (PD), and *More Precisely* (MP). Reading assignment for ranges of class days will be covered approximately sequentially for those days, and you are advised to have the portion reading assigned for a particular day done before that day's lecture. For example, the first half of a reading assignment split over two lectures should be completed before the first lecture, and the second half before the second lecture. You may also find it helpful to re-read a portion of such an assignment after the lecture in which it is covered.

Dates	Topic/Assignment	Reading/Notes	Pages
Sets, Relations, Infinity			
9/7–14	Naive Set Theory	PD1.1–1.6, MP1	32
9/13	Discussion: Sets 1/2		
9/14	HW 1: Naive Set Theory 1/2		
9/16–30	Relations and Russell's Paradox	MP2, PD1.7–1.11	47
9/20	Discussion: Sets 2/2		
9/21	HW 2: Naive Set Theory 2/2		
9/27	Discussion: Relations 1/2		
9/28	HW 3: Relations 1/2		
9/30–10/7	Infinity	PD2, MP8 (skip 8.4)	27
10/4	Discussion: Relations 2/2		
10/5	HW 4: Relations 2/2		
10/11	Discussion: Infinity		
10/12	HW 5: Infinity		
Probability, Decisions, Games			
10/12–14	Probability of Events and Propositions	PD7.1–7.4, PSpp12–15, MP5.1–5.3, 5.7.1	20
10/13–15	Mid-term presentation: initial topic discussion		
10/18	Discussion: Probability of Events and Propositions		
10/19	HW 6: Probability of Events and Propositions		
10/19–21	Conditional Probability and Independence	PD8.2, 9.1, PSpp15–25, MP5.5	17
10/20–22	Mid-term presentation: draft presentation feedback		
10/25	Discussion: Conditional Probability, Independence, and Bayes' Theorem 1/2		
10/26	Mid-term Presentation due		
10/26	Bayes' Theorem	PD8.4, MP5.6	7
10/28		lecture pre-recorded	
10/28–11/2	Random Variables and Expected Value	PS3, pp68–73	18
11/1	Discussion: Conditional Probability, Independence, and Bayes' Theorem 2/2		
11/2	HW 7: Conditional Probability, Independence, and Bayes' Theorem		
11/4–9	Interpretation of Probability	PS1, PD7.5–8.1, 8.3,	

Dates	Topic/Assignment	Reading/Notes	Pages
		MP5.7.2–5.9	28
11/8	Discussion: Random Variables		
11/9	HW 8: Random Variables		
11/11		lecture pre-recorded	
11/11–18	Decisions and Games	MP7	23
11/15	Discussion: Expected Value and Interpretations of Probability		
11/16	HW 9: Expected Value and Interpretations of Probability		
11/23	HW 10: Decision and Game Theory		
11/22	Discussion: Decision and Game Theory		
Statistics and Causality			
11/23–30	Statistical Distributions	PSpp81–90, 108–120, 124–126, 129–130, 132–135, skip paras. on MGF on pp 86, 87, 111, 112, 115, and 125, and Poisson dist. on p 119	29
11/29		No discussion section	
12/2–7	Statistical Inference	PS9, pp165–169, skip example on pp 156–158	26
12/6	Discussion: Statistical Distributions & Statistical Inference 1/2		
12/8–10	Final Presentation: initial topic discussion		
12/9–14	Correlation, Causation, and Causal Models	PSpp73–75, PD9.2–9.9, Hitchcock	25
12/13	Discussion: Statistical Distributions & Statistical Inference 2/2		
12/14	HW 11: Statistical Distributions & Statistical Inference		
12/15–17	Final Presentation: draft presentation feedback		
12/21	HW 12: Correlation, Causation, and Causal Models	due 8 a.m.	
TBA	Discussion: Correlation, Causation, and Causal Models		
12/21	Final Presentations	Finals period: 8–10 a.m.	