PHIL 5209: Mathematical Methods for Philosophy (Fall 2019, 4 units)

August 29, 2019

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: Tu 2:30–3:30, Th 11:15–12:15, and by appointment in Heller 754

Course Website: `https://canvas.umn.edu/courses/132254`. Please check Canvas often for course updates.

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

- 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.

As a prerequisite, students are expected to have taken a course or have some background in mathematics, logic, or the mathematical sciences. Discussion sections will focus on review of and practice with new concepts and methods introduced.

Topics and Applications

The course is divided thematically into two parts, listed below with sample applications, and with an optional third part, time and interest permitting.

Sets, Machines, Infinity

- Paradoxes (Russell's, Barber's)
- Use/Mention and Type/Token distinctions
- Mereology
- Structuralism (in philosophy of mathematics)
- The Continuum Hypothesis
- Identity (personal and otherwise), persistence, and discernibility
- Causal closure of physical and mental events
- Divine perfection
- Emergence and supervenience
- Levels of reality and justified belief
- Supertasks

Probability, Belief, Decision

- Confirmation theory
- Individual and Collective Theories of evidence
- Rationality
- Conditional statements
- Base rate fallacy
- Causation
- Simpson's paradox
- Utilitarianism

Other Topics (time and interest permitting)

- Statistical testing
- Causal graphs
- Computer simulation: agent-based models

Grading

Basis for Evaluation

Homework (55%) There will be *eleven* homework assignments due at the beginning of certain classes, each worth 5% of your grade. These will be posted on the course Canvas site. You may discuss the homework problems in discussion section and with your classmates but the document you turn in should be your own.

Class Presentation (20%) At the end of the semester, each student will teach a 25-minute lesson on a new mathematical method that they will research during the semester, illustrating it with at least one philosophical application, and providing at least one test question on that method that will go on the final exam (for which, see below). To this end, students are encouraged to register for and attend the *Rethinking Formal Methods in Philosophy* workshop on Sept. 20–21 (`https://samuelcfletcher.com/2019/07/29/workshop-rethinking-formal-methods-in-philosophy/`), where they can get exposure to some of these methods first-hand.

Final Exam (25%) There will be a cumulative, open-book exam in our usual classroom during finals period: 8–10 AM, Monday, Dec. 16.

Extra Credit For each novel typo in the textbooks that you find and report to me, you will receive 0.5% extra credit on your grade.

Understanding Your Letter Grade

How to Compute Your Letter Grade

	$90 > \text{B+} \geq 87$	$80 > \text{C+} \geq 77$	$70 > \text{D+} \geq 67$	
$\text{A} \geq 93$	$87 > \text{B} \geq 83$	$77 > \text{C} \geq 73$	$67 > \text{D} \geq 63$	$\text{F} < 60$
$93 > \text{A–} \geq 90$	$83 > \text{B–} \geq 80$	$73 > \text{C–} \geq 70$	$63 > \text{D–} \geq 60$	

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 Policy: Student Conduct Code. To review the Student Conduct Code, please see: `http://regents.umn.edu/sites/regents.umn.edu/files/policies/Student_Conduct_Code.pdf`.

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."

Use of Personal Electronic Devices in the Classroom

Using personal electronic devices in the classroom setting can hinder instruction and learning, not only for the student using the device but also for other students in the class. To this end, 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. (For complete information, please reference: `http://policy.umn.edu/education/studentresp`.)

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 and social media. Students violating this policy will be asked to put their offending device away for the rest of the class session, and may also lose participation credit for that day.

Scholastic Dishonesty

You are expected to do your own academic work and cite sources as necessary. Failing to do so is scholastic dishonesty. Scholastic dishonesty means 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. (Student Conduct Code: `http://regents.umn.edu/sites/regents.umn.edu/files/policies/Student_Conduct_Code.pdf`.) 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: `http://policy.umn.edu/education/instructorresp`.

The Office for Student Conduct and Academic Integrity has compiled a useful list of Frequently Asked Questions pertaining to scholastic dishonesty: http://www1.umn.edu/oscai/integrity/student/index.html. If you have additional specific questions regarding what would constitute scholastic dishonesty in the context of this class, please ask.

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: http://policy.umn.edu/education/makeupwork.

Under such legitimate circumstances leading a student to be absent for any graded activity, that student must contact me about it at least two weeks in advance, or as soon as possible if the circumstances are known later, with the exception of a single episode medical absence that does not require medical services.

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: http://policy.umn.edu/education/studentresp.

Sexual Harassment

"Sexual harassment" means unwelcome sexual advances, requests for sexual favors, and/or other verbal or physical conduct of a sexual nature. Such conduct has the purpose or effect of unreasonably interfering with an individual's work or academic performance or creating an intimidating, hostile, or offensive working or academic environment in any University activity or program. Such behavior is not acceptable in the University setting. For additional information, please consult the Board of Regents' policy on the matter: http://regents.umn.edu/sites/regents.umn.edu/files/policies/SexHarassment.pdf.

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: http://regents.umn.edu/sites/regents.umn.edu/files/policies/Equity_Diversity_EO_AA.pdf.

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. If you are registered with the DRC and have a current letter requesting reasonable accommodations, please contact me as early in the semester as possible to discuss how the accommodations will be applied in the course. For more information, please see the DRC website, https://diversity.umn.edu/disability/.

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: http://www.mentalhealth.umn.edu.

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. Valerie Tiberius (tiberius@umn.edu), your adviser, or College of Liberal Arts Associate Dean for Arts and Humanities Jane Blocker (block023@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 *Philosophical Devices* (PD) and *More Precisely* (MP); you are advised to have the reading assigned for a particular day done before that day's lecture. Homework will be posted on the course Canvas site at least one week before it is due.

Topic	Weeks	Reading	Pages
Sets, Machines, Infinity	**7**		
Naive Set Theory	1.5	PD1.1–1.6, MP1	32
Relations and Russell's Paradox	2	MP2, PD1.7–1.11	47
Machines (Finite Deterministic Automata)	1	MP3	21
Infinity	1	PD2.1–2.3, MP8	23
Bigger Infinities	1.5	PD2.4–3, MP9	34
Probability, Belief, Decision	**5.5**		
Probability of Events and Propositions	1	PD7.1–7.4, MP5.1–5.3, 5.7.1	16
Conditional Probability and Independence	0.5	PD8.2, 9.1, MP5.4	7
Bayes' Theorem	0.5	PD8.4, MP5.6	7
Interpretation of Probability	1	PD7.5–8.1, 8.3, MP5.7.2–5.9	17
Probability of Conditionals	0.5	PD8.5–8.8	6
Correlation and Causation	0.5	PD9.2–9.9	10
Decisions and Games	1.5	MP7	23
Other Topics	**1**		
Statistical Testing		TBA	
Causal Graphs			
Computer Simulation: Agent-Based Models			
Student Presentations	**0.5**		