

Introduction to Formal Reasoning and Decision Making

Philosophy 109
Section 01, Fall 2021

Instructor: Dr. Max Bialek
Lecture: Tu 11am–12:20pm (CDL-103)

Email: mbialek@rutgers.edu
Office Hours: TBA

Course Description. “Fundamentals of logical, probabilistic, and statistical thinking, as well as the basic principles of rational decision making. Reasoning through data (and rhetoric) encountered on a daily basis using elementary principles of deductive logic and inference.”

Resolving differences of opinion isn't always impossible. Figuring out what you should believe isn't just a matter of checking what's true. Deciding what you should do doesn't have to be left up to your whim. Formal tools have been (and continue to be) developed that enable us to talk very precisely about the strength of arguments and of evidence, the rationality of beliefs we have, and the value of choices we make.

This course will introduce students to some of those formal tools and their applications to formal reasoning and decision making: Sentential Logic will be used as a model for expressing ourselves carefully and judging deductive arguments. Probability and Statistics serve as tools for making inductive inferences, evaluating evidence, and quantifying risk and uncertainty. Decision Theory and Game Theory will provide methods that employ those logical and probabilistic tools in order to help guide our decision making. For all of these, we will also discuss their peculiarities, limits to their application, and their potential for expansion and sophistication.

Core Curriculum Learning Goals. Please note that this course satisfies the SAS Core Quantitative and Formal Reasoning learning goals

- (QQ) Formulate, evaluate, and communicate conclusions and inferences from quantitative information.
- (QR) Apply effective and efficient mathematical or other formal processes to reason and to solve problems.

This is a Philosophy course, so the qualitative conceptual foundations and implications of the mathematics discussed will constitute a significant portion of the course material on which you are assessed. However, quantitative mathematical skills themselves will play no less of a role in the course material and assessment. It is assumed that you have some pre-college level mathematical skills (especially algebra and fractions), and success in this course depends heavily on the *kind* of thinking that one has to do in math classes.

If you are concerned about the math content of this course or whether you are prepared for it, please discuss the matter with the instructor as soon as possible.

Course Website. The course website is done through Canvas, and is available directly at <https://rutgers.instructure.com/courses/135342>. It is expected that you turn on alerts for announcements made on the site so that you can stay up-to-date on any changes to the course.

Course Materials. We will be working exclusively from a book PDF provided by the instructor that will be hosted on the course's Perusall site (available via the course Canvas site).

Each chapter of the book ends with practice exercises. Solutions to those exercises can be found in the first appendix of the book, and video walkthroughs of some of the exercises will be posted to the course site.

Accessibility and Accommodations. Any needed accommodations or issues that might affect your academic performance should be brought to the attention of the instructor as soon as possible. Consult with the instructor or any of the following offices for help or more information:

- [Academic Advising](#)
- [Student Health and Counseling](#)
- [Office of Disability Services](#)
- [Violence Prevention and Victim Assistance](#)
- [Scarlet Listeners](#)

Student Conduct. You should make sure you are familiar with the rules regarding proper academic conduct as detailed at the [Student Affairs' Academic Integrity website](#). Additional information regarding student conduct in general is available at the [Office of Student Conduct website](#).

Assessment. The course is divided into three units—*Logic*, *Probability*, and *Decisions*—and eleven topics (four each in the first two units, and three in the third unit) that correspond with single chapters in the book. Assessment will be based on a mixture of exams, quizzes, and participation in both live meetings and asynchronous online discussions.

Each of the three units of the course will end with an exam worth 25% of the course grade. The lowest exam grade will be dropped, for a total of 50% of the course grade coming from exams. This means that if you do poorly on first or second exam, you can make up for it with the third exam, or, if you are happy with your grade going into the third exam, you can skip it. Exams will require you to upload video answers and images of work that you do on paper. The first two exams will be conducted online during the regular scheduled course period and the third will be held at the time assigned to the course for a final exam.

There will be 11 online quizzes (one for each chapter), each worth 2% of the course grade. Each quiz may be taken twice, with the higher score being retained. The lowest of the 11 (retained) quiz grades will be dropped, for a total of 20% of the course grade.

There will be 11 asynchronous online discussion assignments (one for each chapter) conducted through **Perusall** (see below for more information). These will each be worth 3% of the course grade, and the lowest scoring discussion will be dropped, for a total 30% of the course grade being based on discussion posts.

In short:

30% — 10 Discussions at 3% each (best of 11)

20% — 10 Quizzes at 2% each (best of 11)

50% — 2 Exams at 25% each (best of 3)

All grades will be given in numerical form. The course grade will be based on the weighted average described above, and the following scheme will be used to convert its numerical value to a letter grade:

$$A \geq 90 > B+ \geq 87 > B \geq 80 > C+ \geq 77 > C \geq 70 > D \geq 60 > F$$

Extra Credit. The “best of” structure to the course’s grading makes the last discussion post, the last quiz, and *entire third exam* function as extra credit that is already built into the course.

Please do not ask for additional extra credit.

Perusall. Perusall helps you learn faster by collaboratively annotating the readings and communicating with your classmates. Collaboration gets you help whenever you need it, makes learning more fun, enables you to help others (which research shows is also a great way for you to learn), and helps your instructor improve the course by emphasizing information that you need.

If you have a question or information to share about a passage in the readings, highlight the text and type in a comment as an annotation. You can also respond to a classmate’s annotation in threads in real time or upvote questions you find helpful. Good annotations contribute to the class by stimulating discussion, explaining your thought processes, helping others, and drawing attention to good points. (I strongly encourage you to look at [these examples](#) and to pay special attention to what is said about the “meets expectations”/“improvement needed”/“deficient” ratings.) If a particular classmate’s point is relevant, you can explicitly @/mention them and they will be immediately notified, even if not presently signed on—you can even mention the instructor if you’d like to specifically request their input on a discussion.

Research shows that the following behaviors on Perusall predict higher end-of-semester grades and long term mastery of the subject:

- Contributing thoughtful questions and comments to the class discussion, spread throughout the entire reading
- Starting the reading early
- Breaking the reading into chunks (instead of trying to do it all at once)
- Reading all the way to the end of the assigned reading

- Posing thoughtful questions and comments that elicit responses from classmates
- Answering questions from others
- Upvoting thoughtful questions and helpful answers

The extent to which you do these things will play a role in determining your score. Between them, there is 180% of a full score to be earned, so you do not actually have to do any of them perfectly. If you are concerned about your score on a particular assignment, you can contact the instructor for advice on where there is room for improvement.

Live Meetings. The live meetings will—student participation permitting—be structured less like a lecture and more like office hours where most of the time will be used for back-and-forth Q&A and activities like breaking up into groups to do practice problems before working through them as a class.

The most reliable way to succeed in this course is by being present, prepared, engaged, and asking questions if you don't understand something. Our synchronous meeting time is, first and foremost, an opportunity for you to interact with the instructor so as to improve your understanding of the course content. Passively listening to a live meeting discussion or exercise walk-through is likely to help you even less than simply sitting on your own and reading the book. Everyone—you, the instructor, and the rest of the class—will have a better time and learn more when course content is *discussed* and not merely reported.

If you expect to miss any live meetings, please use the University's [absence reporting website](#) to indicate the date(s) and reason(s) for your absence.

Regarding COVID-19. Everyone must wear a suitable mask during in-person meetings and anyone without a suitable mask will be asked to leave.

This and any other policies may be subject to change as guidance and rules relating to COVID-19 are revised.

Contact Information. If you need to be in touch, please email the instructor at

mbialek@rutgers.edu

Use your official Rutgers email address when you email the instructor—as a matter of FERPA compliance, there are many matters that cannot be discussed using personal email addresses. Also, it is recommended that you do not use Canvas' Inbox system as it has issues handling attachments and you will be less likely to get a timely response.

Lateness Policy. Exams can only be completed during precisely the time for which they are scheduled (barring any serious issues).

Quizzes have recommended due dates on Canvas, must be taken in order (e.g. you have to take Quiz 1 before you can take Quiz 2), and all the quizzes for a unit must be taken before that unit's exam (e.g. you have to take Quizzes 1–4 before you can take Exam 1). There are otherwise no penalties for late quizzes.

Discussions on Perusall, being collaborative, due demand a degree of timeliness. There is, however, ample opportunity to earn credit after the due date according to the following rules:

- You cannot earn more credit after the due date than what you earned before.
For example: If you did nothing prior to the due date, then you cannot earn any credit after the due date. If you would have received a 35 for the work done prior to the due date, then you would be able to earn at most another 35 points for work done after the due date (for a maximum assignment score of 70). You will be able to get full credit on the assignment as long as you do work corresponding to at least half credit prior to the due date.
- Replies to annotations will earn full credit for up to *one week* after the due date (except when such credit would conflict with the first rule).
- New annotations can be made for credit up to four days after the due date (except when such credit would conflict with the first rule), but the credit earned is reduced in linear proportion to how late the annotation was made.
For example: A new annotation posted just an hour after the due date would be awarded 99% of the credit it would have earned prior to the due date (since it came 95 hours prior to end of the four-day/96-hour lateness window, and $95/96 \approx 0.99$). A new annotation posted exactly one day after the due date would get 75% credit, two days late would get half credit, and so on...

Schedule. Below is a *tentative* schedule for the course. Check the course website announcements at least once a week for any possible changes. Readings should be done *before* the class on which they are listed. Note that the online quizzes and discussion posts are not listed below—one of each will be due per chapter, and specific due dates will be listed online.

Sep 7 *first day of class*

- **Unit I: Logic**

Sep 14 Chapter 1: Simple Sentences

Sep 21 Chapter 2: Complex Sentences

Sep 28 Chapter 3: Translations

Oct 5 Chapter 4: Arguments

Oct 12 Exam 1

- **Unit II: Probability**

Oct 19 Chapter 5: Classical Probability

Oct 26 Chapter 6: Axiomatic Probability

Nov 2 Chapter 7: Frequentism

Nov 9 Chapter 8: Bayesianism

Nov 16 Exam 2

- **Unit III: Decisions**

Nov 23 Chapter 9: Representing Decisions

Nov 30 Chapter 10: Decision Rules

Dec 7 Chapter 11: Games

TBA Exam 3