LPS 31: Introduction to Inductive Logic

Summer Session II, 2021

Instructor: David Freeborn
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Lectures: Tu 1:00- 3:50p, Th 1:00- 3:50p
Zoom for classes: https://uci.zoom.us/j/98809993530
Office Hours: Mon 11:00- 12:00 or email to make an appointment
Zoom for office hours: https://uci.zoom.us/j/94466096086
Course Website: https://canvas.eee.uci.edu/courses/38747

Description: This course is an introduction to inductive logic. Inductive logic is the study of "risky" reasoning under uncertainty, which, after all, is how most of our reasoning is done. We begin by reviewing deductive logic, before moving onto informal inductive reasoning. We then develop tools of probability theory to study inductive reasoning quantitatively. The key tool will be Bayes' theorem. Then, we investigate the application Bayes' theorem, as well as frequentist methods (p-values) to science, and consider the advantages and potential problems associated with each method. We briefly discuss certain key results of Bayesian reasoning, that allow for the possible of learning under certain assumptions. Finally, we look at some key puzzles with the process of induction: the problem of induction and so-called "Grue" paradox.

Expectations: By the end of this course, hopefully you should be able to recognize an inductive argument and to assess its cogency; to be competent in basic probability calculations and their application to decision-making; and to understand how probability theory is related to evidence and rational belief. You should understand the meaning of Bayesian statistics and p-values in a scientific context and be able to assess their limitations. You should have some sense of when these tools can and cannot be applied appropriately. You should be able to connect these themes of induction to various contexts, including medicine, machine learning and artificial learning, cognitive science and psychology, as well as their relevance for the scientific method itself, as well as everyday reasoning.

Textbooks: These course notes should provide you everything you need to know for the course. However, those interested in supplementary reading material might consider:

- *Introduction to Probability and Inductive Logic*, by Ian Hacking,
- *Choice and Chance: An Introduction to Inductive Logic*, by Brian Skyrms,
- *Odds & Ends: Introducing Probability & Decision with a Visual Emphasis* by Jonathan Weisberg.

All texts are available on the course website. You **don't** need to purchase these or any other books!!!

Makeup Exams: If you need a makeup exam, let me know as soon as you can.

Students with Disabilities: Let me know by email if you think you need any accommodations for this course. I am very happy to be flexible about if you let me know.

Academic Integrity: UCI has a strict policy on academic dishonesty. Cheating on exams will be reported to the appropriate authorities, with no exceptions. Although you are welcome to collaborate on homework problems, all submitted work must be in your own words. Dishonesty in any capacity in this course will not be tolerated.

Zoom participation: Your participation grades are simply for turning up to the classes on zoom. You do not need to have your cameras on, and you do not need to speak if you do not wish to. However, I will give out plentiful bonus points for students who participate actively by talking through their answers, asking questions or engaging in discusssions. Furthermore, whilst cameras are not compulsory, I can teach better if I can see your faces and gauge your reactions, so I strongly encourage those who can to turn their cameras on. In doing so, you will help me to teach better, and helping everyone in the class to learn better.

Zoom classes and lectures will be recorded. If you cannot make the specified times, you need to let me know in advance, in order to get exemptions from the participation requirements.

Course Schedule:

August 3rd	Course Introduction and Deductives Logic	
August 5th	Inductive Inference	
August 10th	Introduction to Probability Theory	**Hwk 1 due**
August 12th	Probability and Propositions	
August 17th	Probability Calculus	**Hwk 2 due**
August 19th	Bayes' Theorem	
August 24th	Bayes, Base Rates and p-values	**Hwk 3 due**
August 26th	Learning and Induction	
August 31st	Learning and Induction (continued)	**Hwk 4 due**
September 2nd	Puzzles and Paradoxes	**Final Exam assigned**
September 10th		**Final Exam due**

Homeworks: The idea is to submit the problem sheets on the course canvas page. If possible please submit as a pdf file; however, other formats are acceptable. Please let me know in advance if there is some problem with submitting the homeworks.

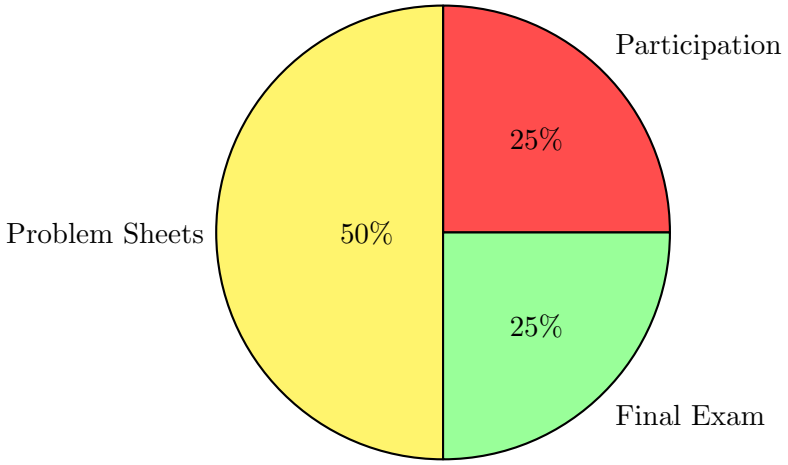
Grading: Grades will be based on:

- Participation (25%)
  To get the participation grade, turn up to each class or send me an email *in advance* to let me know if you cannot make a class for a good reason.

- Weekly problem shseets – (50%)
  Submit the weekly problem sheets on Canvas. The grade is based making an effort to answer every problem, whether or not the answer is correct. Submit your completed homeworks on the canvas page. Let me know in advance if you have any trouble completing or uploading your homework problems. You are encouraged to work together if that is helpful for you. We will discuss the answers to each problem sheet in the following class, and I will hand out answer sheets then.

- Open book end of term exam (25%) The exam questions will be **very closely** based on problem sheet questions. There will be no surprises. The best way to practice for the exam is to do the problem sheets.

- Bonus points will be handed out liberally throughout the course.
  In particular, I will hand out bonus points for answering and explaining the homework problems in class, or for any other insightful questions or comments in class. Another way to earn bonus points is by finding mistakes in these lecture notes (there are here to test you) and letting me know.



Letter grades will be assigned as follows: $A \geq 93 > A- \geq 90 > B+ \geq 87 > B \geq 83 > B- \geq 80 > C+ \geq 77 > C$; etc.

Final Exam The final exam is open book, and will be sent out to you on September 2nd. It will be due 8 days later (September 10th). The exam questions will be **closely** based on problem sheet questions. There will be no surprises.