Scientific Reasoning [Phil 108, section 001]
[Spring/Fall Year]

Course Number:
Course meeting time/location:
Mode of course: In person
Instructor: Professor Ryan O'Loughlin (email: Ryan.Oloughlin@qc.cuny.edu)
Office Hours:
Office Location: Powdermaker Hall 350V

Overview: In this course we will cover some fundamentals of logic and then investigates the kinds of logic & reasoning involved in the pursuit of scientific knowledge. Some of the topics we will discuss in this course: the differences between inductive and deductive reasoning, translation of propositions into logical symbols, truth tables, probabilistic and statistical reasoning, causal arguments, and explanatory reasoning. More broadly, we will investigate questions about the nature and justification of scientific knowledge, e.g., why does science offer evidence and explanations rather than decisive proofs?

Learning outcomes (LOs)* After taking this course you should have a better understanding of what scientific reasoning entails, how it is used in various contexts, and how to evaluate or follow-up on scientific studies reported in the news or on social media.

More specifically, by the end of this course, you will be able to:

- **(LO1)** Distinguish between different types of reasoning, including deductive, inductive, and explanatory reasoning, and know how they apply to reasoning in science
- **(LO2)** Explain the logical concepts of validity, consistency, and contradiction using truth tables
- **(LO3)** Use basic ideas from probability to assess the degree to which evidence supports a conclusion
- **(LO4)** Evaluate the strength of causal arguments offered in case studies from epidemiology, nutrition science, and environmental science

*This course fulfills Pathways Requirement *Scientific World* (SW) learning outcomes 1-5.

Reading Materials for Course:

Required text to purchase: Merilee Salmon's *Introduction to Logical and Critical Thinking* 6th edition (2013) ISBN: 978-1133049753

Text can be purchased on Amazon as an e-book ($45).

All other readings will be made available on the course webpage

Basis for Grading[1]:

[1] Queens College grading scale: https://www.qc.cuny.edu/aac/academic-and-grading-policies/

Homework Assignments……12 @ 10 points each…….....120 points
In-class activities……12 @ 10 points each……..120 points
Exam 1……..…..……..….80 points
Exam 2…….…..80 points
Final Exam (cumulative) ……..……...150 points
Total: 550 points

Homework Assignments

Most weeks you will be assigned a problem set to work through. This will give you an opportunity to review the concepts and methods covered in class. The problem sets will be 6-10 questions in length. Their due date is timed so that you can visit my office hours if you have questions / would like assistance or feedback before turning them in.

In-class activities

I will regularly assign pop quizzes and group activities. These are meant to be low-stakes and are intended to (i) reinforce key lessons from class; and (ii) give you an opportunity to critically think about the material with your peers. Only by actively working through problems—in contrast to passively watching me work through problems—will you be able to gauge your own learning progress and identify what you need to study.

Exams

Exams will have a combination of multiple-choice questions and open-ended questions. Exams 1 and 2 are non-cumulative and will be 20 questions in length. The final exam is cumulative and will be 30 questions in length.

Note on participation and attendance
Participation is strongly encouraged – the best learning takes place when you have skin in the game, when you risk failure, and when you acknowledge what you don't know by asking questions. Moreover, we all will benefit from each of you offering your ideas and perspectives! Although I do not formally take attendance*, you must attend class in order to complete the in-class activities.

*If you have to miss class for a family or medical reason, please let me know and we will work together to make sure you don't fall behind.

Schedule [Dates are placeholders from SP 2024]

Week/Topic/Date	**Readings/podcasts/videos**	**Notes, HW due, etc.**	Learning
Wk1. Introductions			
TH 1/25	1st day; no readings		
Wk2. What is logic? What is an argument?			

T 1/30	Salmon Ch. 1		LO1, LO2
TH: 2/1		**Hw 1 due**	
Wk3. On reading logically			
T 2/6	Salmon Ch. 2		FC3
TH 2/8		**Hw 2 due**	FC3
Wk4. Deductive and inductive arguments		Validity; soundness	
T 2/20	Salmon Ch. 3	**Hw 3 due**	LO1
TH 2/22	**Our class does not meet (classes follow Monday schedule)**		
Wk5. Propositional logic		Translation into logical symbols	
T 2/27	Baronett Ch. 7A-7C [Stan Baronett's *Logic* 3rd ed. (2016)]		SW2
TH 2/29		**Hw 4 due**	SW2
Wk6. Propositional logic (cont'd)		Truth tables; consistency; contradiction; validity revisited	
T 3/5	Baronett Ch. 7D – 7F		LO1, LO2, FC2, SW2
TH 3/7		**Hw 5 due**	LO1, LO2, FC2, SW2
Wk7. Exam and begin Inductive arguments			
T 3/12	**Exam 1**		
TH 3/14		Statistical syllogisms	LO3
Wk8. Inductive arguments		Arguments from analogy; arguments based on samples	
T 3/19	Salmon Ch. 4		LO3, SW2
TH 3/21		**Hw 6 due**	
Wk9. Causal Arguments			
T 3/26	Salmon Ch. 5		LO4, SW1
TH 3/28		**Hw 7 due**	LO4, SW1
Wk10. Causal Reasoning in a messy world		Case studies in epidemiology; environmental science; nutrition science	
T 4/2	Ch. 6 of Aschengrau and Seage [*Essentials of Epidemiology in public health*]		LO3, LO4, FC1, FC2, FC3, SW3
TH 4/4		**Hw 8 due**	FC1, FC2, FC3, SW3
Wk11. Causal reasoning (cont'd) and begin probability			
T 4/9	Lloyd, E.A. and Shepherd, T.G., 2021. Climate change attribution and legal		LO3, LO4, FC1, FC2,

	contexts: evidence and the role of storylines. *Climatic Change*, 167(3), p.28.		FC3, SW3, SW5
TH 4/11 **Wk12. Probabilities and inductive logic**		**Hw 9 due**	LO4, FC1, FC2, FC3, SW3
T 4/16	Salmon Ch. 6		LO3, FC2, SW2
TH 4/18	**Exam 2**		
Spring Break			
T 4/23	NO CLASS		
TH 4/25	NO CLASS		
Wk13. Confirmation of hypotheses: the myth of the scientific method			
T 4/30			LO1, LO3, SW2
TH 5/2	Salmon Ch. 7	**Hw 10 due**	LO3, SW2
Wk14. The logic of explanation?			
T 5/7	Lombrozo, T. (2012) "Explanation and Abductive Inference" in *Oxford Handbook of thinking and reasoning*		SW1, LO1
TH 5/9		**Hw 11 due**	
Wk15. When evidence fails			
T 5/14	*The Misinformation Age* (O'Connor and Weatherall) Ch. 2, "Polarization and Conformity."		SW4, SW5
		Hw 12 due	

How to do well in this course: Read the assigned readings, take notes on the readings, participate in discussion, *and ask questions*. Visit office hours or email me if you have any questions about the material in the course. Participate in class discussions (yes, I've listed this twice) and take notes. Most importantly: show up to each class well-rested and willing/ready to learn.

Please reach out to me if you need assistance so I can help you make the most of this course!

Academic Policies and Procedures:

https://qc-undergraduate.catalog.cuny.edu/academic-policies-and-procedures

Info about Title IX and Sexual Misconduct:

https://www1.cuny.edu/sites/title-ix/?post_type=campus_profile&p=154

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