Philosophy 111: Intro to Inductive Logic

Course Description

An introduction to inductive reasoning focusing on the role of probability. The focus of the course is on methods to assess non-deductive, uncertain, and risky inferences from a background of decision and probability theory. Students will learn calculation and inference techniques for assessing conclusions from evidence when the evidence provides an uncertain situation for truth. Competing theories of probability and the role of probability in evidence and knowledge acquisition will be covered. The use of probability and statistics in the news media, the sciences, and academia will be critically assessed.

Recommended Prerequisite

Qualification for Math 100 (Math 75X?)

Textbook

Reasoning about Risk: An Introduction to Inductive Logic and Probable Truth, by Ronald C. Pine (Free online, no cost)

Additional Requirements

Basic calculator that includes square root, square, and exponent. (Most modern cell phones are fine for class use and reading the textbook; but need an inexpensive one for quizzes and exams.)

Special Note

This course will make use of an Online Learning Management System (Laulima or its replacement). Use of UH email is also important. Hence, consistent Internet access is essential. Students are urged not to rely on a cell phone for Internet access. This will be explained more on the first day of class.

Overview
FQ Course

This course will cover the philosophical concepts and issues related to inductive reasoning, epistemology, probability theory and calculations, decision theory, and at-risk inferences. It will also use as important content many examples from modern science and the history of science. The course assumes that scientific methodology is the premier example of empirical evaluation, acceptance, and change in beliefs about what is probably true. As an FQ course, students will learn that mathematical reasoning is not only used to describe what is probably true, but also as a means to test theories about what is probably true. Students will not only learn how to calculate probability, but also learn that mathematical descriptions and calculations provide invaluable perspectives for personal and public policy decisions. A major epistemological theme of the course is that popular, “post-truth” relativistic, assumptions about conflicting beliefs are not true. Rational inferences can be made about what is probably true, especially with the aid of mathematics.

Student Learning Outcomes

By the end of this course, students will

- demonstrate a working familiarity with basic concepts in logic, inductive inference, probability, and decision theory by successfully learning and applying key definitions with a particular focus on creating models for learning from experience.

- demonstrate an ability to set up quantifiable probability models, including diagrams and basic decision procedures.

- demonstrate the capacity to engage in and evaluate “risky” inferences, with the ability to critically assess the implications of modeling behavior as quantifiable, rational action.

- demonstrate an understanding through examination of some of the shortcomings and strengths of employing quantification models in making knowledge claims.

Evaluation

Discussed further the first day of class: Quizzes and Exam are open book and notes. Top 10 quizzes counted.

1. Weekly Quizzes, 200 pts., 50%
2. Midterm, 100 pts., 25%
3. Final Exam, 100 pts., 25%
Course Content

I. Eyes and minds wide open. Logical vulnerability and why critical thinking and numeracy are important.
   A. Paying attention to detail.
   B. Persuasive tricks and bad reasoning with words.
   C. Persuasive tricks and bad reasoning with numbers and statistics.
   D. The importance of numeracy in inductive reasoning.

II. Presenting Orderly Thoughts
   A. Premises
   B. Conclusions
   C. Logical Inferences

III. Types of Logical Argument
   A. Deductive Reasoning: valid, invalid, and sound arguments
   B. Inductive Reasoning: strong (probable) v. weak (improbable) inductive arguments

IV. More on Inductive Reasoning and Reasoning that involves risk
   A. Truth and Probability
   B. Risk and Reliable Beliefs
   C. Scientific Reasoning
   D. Gold Standard Inductive Reasoning: Randomized Controlled Studies
      1. Example 1: Cigarette smoking and lung cancer
      2. Example 2: Vaccines and Autism
   E. Case Study, Beliefs in comparison: Modern astronomical distance computations compared to Biblical and Medieval descriptions and computations
      1. Ptolemaic and Copernican Geometry, empirical equivalence
      2. Eratosthenes and measuring the circumference of the Earth
      3. Parallax, arcseconds, light years, and parsecs
      4. Standard Candles, apparent and absolute magnitudes
      5. Wave lengths, emission and absorption, and red shift

V. Probability theory and calculation
   A. Elementary Probability Ideas
   B. Conditional Probability and the Gambler’s Fallacy
C. The Basic Rules of Probability
D. Bayes’ Theorem, learning from experience, and solution to the Monty Hall problem
E. Detecting public policy mistakes with probability estimates

VI. Values, Utility, and Probability

VII. Frequency Probability and Gold Standard Testing
A. Mean, Standard Deviation, Bernoulli Trials, Normal Approximation
B. Inductive Logic of Significant Tests
C. P-Values
D. Confidence Intervals

VIII. The Problem of Induction and Empirical Equivalence

Epilogue: Are We Alone in the Universe? What is the probability?

Course Theme

We hope to show you the value of being a Reasonist!

Figure 1: Doonesbury cartoon making fun of our conspiracy culture; only a few Reasonists, people who believe in the need for evidence.