

# COMPSCI 333 and STAT 333

## Individual Risk

### **Course Description:** Reading Seminar

Risk assessment tools are increasingly deployed in high-stakes settings: What is the probability that the tumor will metastasize? What is the chance that this individual will commit a violent crime in the next two years? What is the probability that the student will graduate within 4 years? But what is the probability of a non-repeatable event? What is the mathematical meaning of "individual risk" and what should we require of a risk assessment algorithm? This reading course will explore different notions of risk, based on different notions of probability, and will connect this literature to notions of regret and indistinguishability from computer science.

### **Course Instructors: Joe Blitzstein and Cynthia Dwork**

Professor Joe Blitzstein

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Professor Cynthia Dwork

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Office hours: Wednesdays, by appointment.

The course will meet once weekly on Friday afternoons, 1:00 pm – 2:45 pm (Eastern).

### Expectations

The course is only offered SAT/UNSAT. The goal is to collaboratively develop an understanding of the literature. Students, working individually or in groups depending on preference and numbers, will lead discussions of the papers. All students are required to participate actively in all discussions and lead the discussion (individually or in a small group) in at least one of the weeks.

As presenter, you should lead an *interactive* class discussion, not give a lecture. The goals of a presentation are to add insight, clear up confusions and address students' questions and comments, pose interesting questions inspired by the papers, and foster discussions of the papers and related ideas. Do *not* simply summarize the papers; you can assume that everyone has done the reading and is ready to critically discuss it.

In weeks when they are not presenting, students should not only do the reading carefully, but also post at least one substantive question or comment per assigned paper, via the collaborative annotation tool <http://nb.mit.edu>. Invitations to join our collaborative group on this site will be sent to the class list; if you do not receive an invitation, let Joe know. Comments and questions should be posted at least 48 hours before the class meeting, to give presenters enough time to address the comments and questions in their presentations.

### Organizing Principle

The course will use Philip Dawid's paper, *On Individual Risk*, as a blueprint, with the goal of arriving at a deep understanding of this paper and its connection to various literatures by mid-November. Students should read the paper before the first meeting on Friday, September 4, for motivation and an overview of many of the ideas that will be discussed in the course. Students should also post questions or comments at [nb.mit.edu](http://nb.mit.edu) by Wednesday, September 2 at 1:00 pm (Eastern). It is expected that parts of the paper may be difficult; students should just do the best they can, and as the semester progresses we will explore the topics of the paper, and related topics from computer science and statistics, in much more detail.

### **Tentative Schedule of Readings**

September 4 [Dawid, On Individual Risk \(2018\)](#)

September 11 [Hajek, Interpretations of Probability \(2012\)](#)

September 18 [Stark and Freedman, What is the Chance of an Earthquake?](#), [Freedman, Some Issues in the Foundations of Statistics](#), and [Lindley, The Philosophy of Statistics](#)

September 25 [Nate Silver](#); Parmigiani and Inoue, *Decision Theory: Principles and Approaches*, Chapter 10 (Scoring Functions); [Oakes, Self-calibrating priors do not exist \(1985\)](#); and [Dawid, The Well-Calibrated Bayesian](#)

October 2 [Borwein and Zhuang, On Fan's Minimax Theorem](#) and [Boyd and Vandenberghe, Convex Optimization, Chapter 2](#)

October 9 Sandroni, *The Reproducibility Properties of Correct Forecasts*, 2003; and sections 1-3 of Sandroni, Smorodinsky, and Vohra, [Calibration with Many Checking Rules](#). If you have time, read the rest of the paper.

October 16 Parmigiani and Inoue, *Decision Theory: Principles and Approaches*, Chapter 2 (Coherence); and [Dawid, DeGroot, Mortera, Coherent Combination of Experts' Opinions](#)

October 23 [Goldwasser and Bellare, Lecture Notes on Cryptography](#), sections on Indistinguishability

October 30 [Hébert-Johnson, Ú., Kim, M., Reingold, O. and Rothblum, G., 2017, July. Multicalibration: Calibration for the \(computationally-identifiable\) masses](#)

November 6 [Blum and Mansour, From External to Internal Regret, 2007](#)

November 13 Reprise of [Dawid, On Individual Risk \(2018\)](#)

November 20 Synthesis