Course Description: Humans are not born well-equipped to understand random phenomena. But with some mathematical ground rules, and a bit of practice, we can attain a deeper understanding and appreciation of our unpredictable world. Participants will learn fundamental rules for computing probabilities, including the explanations behind some famous paradoxical puzzles, gain insight into statistical practice (including the frequentist vs. Bayesian debate) through a deeper understanding of connections with probability theory, dispel misconceptions and cognitive biases surrounding randomness, and explore simulation as a tool for problem solving and as a means to understand limit theorems.

Day 1: Basic definitions for random experiments, tools for counting, techniques for computing probabilities, the birthday problem, the lottery. Misconceptions: the “100 year” flood, and more.

Day 2: Independence, conditional probability, and Bayes' rule. The Monty Hall problem, disease testing, prosecutor’s fallacy. Connections to statistics: p-values, hypothesis testing, and Bayesian statistics.

Day 3: Random variables (discrete and continuous), moments, and relationships among distributions. The St. Petersburg Paradox, and more.

Day 4: Limit theorems, simulation, how to find pi by throwing darts, other topics requested by participants!