# Proof-Based Math Readings Session: Statistics

2024 Summer

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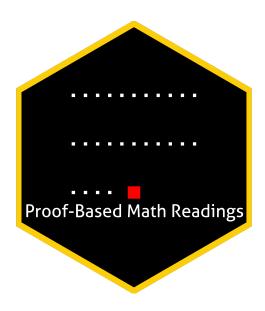
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#### 0 Motivation

- Proof-Based Math Readings is a free and independent online reading group where we study mathematics required in economics master's/PhD programs using an intuitive approach.
- This session of the reading group is on Statistics.

## 1 Prerequisites

- CGPA: 3.00/4.00.
- Introduction to Probability Dimitri P. Bertsekas, John N. Tsitsiklis (2nd Edition, 2008, Summary Material)
- Introduction to Probability Dimitri P. Bertsekas, John N. Tsitsiklis (2nd Edition, 2008, Playlist)
- Introduction to Probability Dimitri P. Bertsekas, John N. Tsitsiklis (2nd Edition, 2008, Solutions & Errata)
- Please use the Application Form to join our reading group.
- Applicants are informed about their application results within a week via email.

### 2 Format

- This session takes 12 weeks.
- We discuss the topics/exercises that we struggle with at Proof-Based Math Readings [Discord].
- We do not have face-to-face/online meetings due to the size of the group.
- Members are expected to read the chapters, and watch the chapter videos from the book's playlist.

### 3 Resources

#### 3.1 Main Book and Main Book's Playlist

Statistical Inference - George Casella, Roger Berger (2nd Edition, 2001 or 2024) is our main book because it is well-written and well-structured. The 2024 version is an errata-free reprint of the 2001 version.

- Statistical Inference George Casella, Roger Berger (2nd Edition, 2001 or 2024)
- Statistical Inference George Casella, Roger Berger (2nd Edition, 2001, Errata)
- Statistical Inference George Casella, Roger Berger (2nd Edition, 2001 or 2024, Solutions)
- Statistical Inference George Casella, Roger Berger (2nd Edition, 2001 or 2024, Playlist for Chapter 1-5)
- Statistical Inference George Casella, Roger Berger (2nd Edition, 2001 or 2024, Playlist for Chapter 5-9)

#### 3.2 Supplementary

#### 3.2.1 Statistics

- Introduction to Mathematical Statistics Jingyi Jessica Li (2022)
- ► Mathematical Statistics Jem N. Corcoran (2024)
- The Book of Statistical Proofs Joram Soch (2024)

#### **3.2.2** Proof

- Book of Proof Richard Hammack (3.3 Edition, 2022)
- Book of Proof Richard Hammack (3.3 Edition, 2022, Playlist by Jeremy Teitelbaum)
- Book of Proof Richard Hammack (3.3 Edition, 2022, Playlist by Michael Penn)

#### 3.2.3 Real Analysis

- Basic Analysis I: Introduction to Real Analysis Jiri Lebl (Version 6.0, 2023)
- Basic Analysis I: Introduction to Real Analysis Jiri Lebl (Version 6.0, 2023, Playlist by Casey Rodriguez)
- Introduction To Metric Spaces Paige Bright (2023)

#### Reading Schedule 4

• SI is the abbreviation of Statistical Inference - George Casella, Roger Berger (2nd Edition, 2001 or 2024).

#### SI, Chapter 1: Probability Theory

Week 01 #

- 1.1 Set Theory, 1.2 Probability Theory, 1.3 Conditional Probability and Independence,
- 1.4 Random Variables, 1.5 Distribution Functions, 1.6 Density and Mass Functions

#### **SI**, Chapter 2: Transformations and Expectations

Week 02 #

- 2.1 Distributions of a Random Variable
- 2.2 Expected Values
- 2.3 Moments and Moment Generating Functions

#### **■** SI, Chapter 3: Common Families of Distributions

Week 03-04

- 3.1 Introduction
- 3.2 Discrete Distributions
- 3.3 Continuous Distributions
- **3.4** Exponential Families
- 3.5 Location and Scale Families
- 3.6 Inequality and Identities

### **■** SI, Chapter 4: Multiple Random Variables

Week 05-06

- ${f 4.1}$  Joint and Marginal Distributions
- 4.2 Conditional Distributions and Independence
- 4.3 Bivariate Transformations
- 4.4 Hierarchical Models and Mixture Distributions
- 4.5 Covariance and Correlation
- 4.6 Multivariate Distributions
- 4.7 Inequalities

#### SI, Chapter 5: Properties of a Random Sample

Week 07-08

- **5.1** Basic Concepts of Random Samples
- **5.2** Sums of Random Variables from a Random Sample
- 5.3 Sampling from the Normal Distribution
- 5.4 Order Statistics
- **5.5** Convergence Concepts
- **5.6** Generating a Random Sample

#### SI, Chapter 6: Principles of Data Reduction

Week 09-10 #

- **6.1** Introduction
- 6.2 The Sufficiency Principle
- **6.3** The Likelihood Principle

#### SI, Chapter 7: Point Estimation

Week 11-12 =

- 7.1 Introduction
- 7.2 Methods of Finding Estimators
- 7.3 Methods of Evaluating Estimators