

STAT4101 (4 credits) Theory of Statistics I

Random variables and distributions; generating functions; standard distribution families; data summaries; sampling distributions; likelihood and sufficiency.

1. Random Variables and Distributions

(a) Setup

- i. Event Algebra
- ii. Counting
- iii. Probability Rules

(b) Describing Distributions

- i. Probability Functions (for discrete variables), Probability Density Functions (for continuous variables), and Cumulative Distribution Functions (for both)
- ii. Joint, Marginal, and Conditional Distributions, and how are related
- iii. Independence

(c) Expected Values, for both discrete and continuous random variables

- i. Mean, Variance
- ii. Expectation any function of the random variable (or variables)
- iii. Using the Linearity of Expectations
- iv. Covariance, Correlation, and how it relates to independence

2. Generating Functions

- (a) Finding and using pgf's (also called fmgf's) and mgf's
- (b) to find the mean and variance of a distribution,
- (c) to find the distribution of the sum of independent variables, and
- (d) to find the distribution of a new variable.

3. Standard Distribution Families

- (a) Bernoulli, Binomial, Hypergeometric
- (b) Geometric, Negative Binomial, Negative Hypergeometric
- (c) Poisson, Exponential, Gamma (including Chi-Squared)
- (d) Normal

4. Data Summaries

- (a) Contingency tables, bar graphs
- (b) Sample mean, standard deviation, correlation
- (c) Stem-leaf plots, histograms, boxplots, and scatterplots

5. Sampling Distributions, Likelihood, and Sufficiency

We didn't get to these topics yet, so we will begin next semester with them.