Statistics 406 Topic List

1. Behavior of the sample mean:
   - Central Limit Theorem (CLT) for \textit{iid} data
   - Effects of data transforms on the mean
   - Examples where the CLT does not apply
   - Behavior of the sample mean for correlated data

2. Introduction to the sampling distribution of a statistic:
   - Bias
   - Variance
   - MSE
   - Relative efficiency

3. Sampling variances for specific estimation problems:
   - Log odds ratio
   - Quantiles
   - Regression slope
   - Ratios of expected values
   - Means based on truncated, censored, and missing data

4. Confidence intervals:
   - Nominal and actual coverage probabilities
   - Effects of plugging in nuisance parameters
   - Bootstrap confidence intervals

5. Hypothesis testing:
   - Power and level
   - Contingency tables: $\chi^2$ and Fisher’s exact test
   - Rank-based tests for location differences
   - Permutation tests for location differences

6. Conditional probability
   - Bayes’ theorem
• Conditional expectation and variance
• Double expectation theorem and law of total variation

7. Maximum likelihood
• Calculation and examples
• Standard errors
• Log likelihood ratios

8. Prediction and classification performance:
• Prediction and classification methods
• Cross-validation

9. Correlation coefficients
• Sampling behavior and hypothesis tests
• Robust estimates
• Behavior with autocorrelated data

10. Cluster analysis
• Methods for identifying clusters
• Stability and significance

11. Multiple testing
• Bonferonni method
• False Discovery Rate (FDR)