Outline of Lessons for ISyE 6739 Probability/Statistics – 200114

0. Course Introduction + Bootcamps
    - Lesson 0.1: Syllabus
    - Lesson 0.2: Introduction to Probability and Statistics
    - Lesson 0.3: The Joy of Sets Bootcamp
    - Lesson 0.4: Calculus Bootcamp: Introduction + Derivatives
    - Lesson 0.5: Calculus Bootcamp: Integration and Beyond

1. Getting Started with Probability
    - Lesson 1.1: Experiments, Sample Spaces, and Events
    - Lesson 1.2: What is Probability?
    - Lesson 1.3: Basic Probability Results
    - Lesson 1.4: Finite Sample Spaces
    - Lesson 1.5: Counting Techniques: Baby Examples
    - Lesson 1.6: Counting Techniques: Permutations
    - Lesson 1.7: Counting Techniques: Combinations
    - Lesson 1.8: Hypergeometric, Binomial, and Multinomial Problems
    - Lesson 1.9: Permutations vs. Combinations
    - Lesson 1.10: The Birthday Problem
    - Lesson 1.12: The Envelope Problem
    - Lesson 1.12: Poker Problems
    - Lesson 1.13: Conditional Probability
    - Lesson 1.14: Independence Day
    - Lesson 1.15: Partitions and the Law of Total Probability
    - Lesson 1.16: Bayes Theorem

2. Random Variables
    - Lesson 2.1: Introduction
    - Lesson 2.2: Discrete Random Variables
    - Lesson 2.3: Continuous Random Variables
    - Lesson 2.4: Cumulative Distribution Functions
    - Lesson 2.5: Great Expectations
    - Lesson 2.6: LOTUS, Moments, and Variance
    - Lesson 2.7: Approximations to E[$h(X)$] and Var($h(X)$)
    - Lesson 2.8: Moment Generating Functions
    - Lesson 2.9: Some Probability Inequalities
    - Lesson 2.10: Functions of a Random Variable
    - Lesson 2.11: Inverse Transform Theorem
    - Lesson 2.12: Honors Bonus Results

3. Bivariate Random Variables
    - Lesson 3.1: Introductiom
    - Lesson 3.2: Marginal Distributions
    - Lesson 3.3: Conditional Distributions

- Lesson 3.4: Independent Random Variables
- Lesson 3.5: Consequences of Independence
- Lesson 3.6: Random Samples
- Lesson 3.7: Conditional Expectation
- Lesson 3.8: Double Expectation
- Lesson 3.9: First-Step Analysis
- Lesson 3.10: Random Sums of Random Variables
- Lesson 3.11: Standard Conditioning Argument
- Lesson 3.12: Covariance and Correlation
- Lesson 3.13: Correlation and Causation
- Lesson 3.14: A Couple of Worked Correlation Examples
- Lesson 3.15: Some Useful Covariance / Correlation Theorems
- Lesson 3.16: Moment Generating Functions, Revisited
- Lesson 3.17: Honors Bivariate Functions of Random Variables

4. Distributions
    - Lesson 4.1: Bernoulli and Binomial Distributions
    - Lesson 4.2: Hypergeometric Distribution
    - Lesson 4.3: Geometric and Negative Binomial Distributions
    - Lesson 4.4: Discrete Distributions: Poisson Distributions
    - Lesson 4.5: Uniform, Exponential, and Friends
    - Lesson 4.6: Other Continuous Distributions
    - Lesson 4.7: Normal Distribution: Basics
    - Lesson 4.8: Standard Normal Distribution
    - Lesson 4.9: Sample Mean of Normals
    - Lesson 4.10: The Central Limit Theorem + Proof
    - Lesson 4:11: Central Limit Theorem Examples
    - Lesson 4.12: Extensions – Multivariate Normal Distribution
    - Lesson 4.13: Extensions – Lognormal Distribution
    - Lesson 4.14: Computer Stuff

5. Getting Started with Statistics
    - Lesson 5.1: Introduction to Descriptive Statistics
    - Lesson 5.2: Summarizing Data
    - Lesson 5.3: Candidate Distributions
    - Lesson 5.4: Introduction to Estimation
    - Lesson 5.5: Unbiased Estimation
    - Lesson 5.6: Mean Squared Error
    - Lesson 5.7: Maximum Likelihood Estimation
    - Lesson 5.8: Trickier MLE Examples
    - Lesson 5.9: Invariance Property of MLEs
    - Lesson 5.10: Method of Moments Estimation
    - Lesson 5.11: Sampling Distributions

6. Confidence Intervals
    - Lesson 6.1: Introduction to Confidence Intervals

- Lesson 6.2: Normal Mean (variance known)
- Lesson 6.3: Difference of Two Normal Means (variances known)
- Lesson 6.4: Normal Mean (variance unknown)
- Lesson 6.5: Difference of Two Normal Means (unknown *equal* variances)
- Lesson 6.6: Difference of Two Normal Means (variances known)
- Lesson 6.7: Difference of Paired Normal Means (variances known)
- Lesson 6.8: Normal Variance
- Lesson 6.9: Ratio of Variances of Two Normals
- Lesson 6.10: Bernoulli Proportion

7. Hypothesis Testing
    - Lesson 7.1: Introduction to Hypothesis Testing
    - Lesson 7.2: The Errors of Our Ways
    - Lesson 7.3: Normal Mean Test with Known Variance
    - Lesson 7.4: Normal Mean Test with Known Variance: Design
    - Lesson 7.5: Two-Sample Normal Means Test with Known Variances
    - Lesson 7.6: Normal Mean Test with Unknown Variance
    - Lesson 7.7: Two-Sample Normal Means Tests with Unknown Variances
    - Lesson 7.8: Two-Sample Normal Means Test with Paired Observations
    - Lesson 7.9: Normal Variance Test
    - Lesson 7.10: Two-Sample Normal Variances Test
    - Lesson 7.11: Bernoulli Proportion Test
    - Lesson 7.12: Two-Sample Bernoulli Proportions Test
    - Lesson 7.13: Goodness-of-Fit Tests: Introduction
    - Lesson 7.14: Goodness-of-Fit Tests: Examples
    - Lesson 7.15: Goodness-of-Fit Tests: Honors Example