Math 3215: Final Exam Topics

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1   General Things

- There are not too many topics here - the important thing is to know them all very thoroughly. I'd prefer you left this class knowing a handful of things completely than knowing many things superficially

- Know the key definitions, but also understand how things fit together and understand the wider context

- Understand how to put the statistical theory into practice. What questions can statistics give answers to and what kind of answers does it give?

- Know the main probability distributions we've talked about and in what contexts they each arise

- Sanity-check your answers - is the sign and approximate size of your answer about what you'd expect?

- Understand how things fit together. For example,

  - How do expectation, variance and the CLT relate to statistics?
  - What's the relationship between the Binomial, Poisson and Normal distributions?
  - What probabilistic assumptions do we often make when running a statistical experiment? Are these assumptions reasonable?
  - What is the right level of detail to include in a probability model?

2   Basic Probability

- Outcomes, Events, and Probabilities
- Independence
- Venn diagrams
- Inclusion / Exclusion
- Basic set theory

3 General Random Variables

- Expectation

- Linearity of Expectation

- Variance

- Independence

- Covariance

- CDF's

- Maximums and Minimums of a collection of rv's

- Joint Distributions

4 Discrete Random Variables

- Probability mass functions

- Coin flips

- Poisson distribution

- Geometric distribution

- Binomial distribution

5 Continuous Random Variables

- Density Functions

- Uniform Distributions

- Normal Distributions

- Exponential Distributions

- Chi Square distribution

6 More probability

- Central Limit Theorem

- Law of Large Numbers

- Chebyshev's Inequality

- Random Graphs

7   Statistics

- Basic Statistical Method: Null hypothesis, alternate hypothesis, p-value, confidence level
- Parameter Estimation
- Unbiased Estimators
- Maximum Likelihood Estimator
- Confidence Intervals
- one-sided confidence intervals
- Regression
- Goodness-of-fit
- Hypothesis testing
- Chi square test statistic
- Chi square test of independence, goodness-of-fit