MATH 3080 - Midterm I - Checklist

Here is a checklist of topics to help you review for the first midterm. It is meant to serve as a guide to help with studying for the exam.

Sampling Distributions - Ch 4

1. Random Samples, what are they (IID)
2. Limit theorems, know what the Law of Large numbers and Central Limit Theorems are and what they say/mean
3. Sampling from normal populations, know properties of sample means/ sample variances (know the definitions)
   (a) Chi square distribution, what is it? Why do we care about it?
   (b) Students t-distribution, how is it defined, where does it arise naturally?
   (c) **DO NOT need to know F- distribution**
4. Order Statistics, what are they? How do you derive the formula for the largest and smallest ones?
5. Normal approximation to the Binomial. When does it apply? How do you apply it? Continuity corrections?
6. Inverse CDF sampling. How do you sample any continuous RV from a $U(0,1)$ RV by inverting the CDF?

Statistical Estimation - Ch 5

1. What is a point estimator? What are some examples?
2. What is estimator Bias? How can you make a biased estimator unbiased
3. What is mean square error? How is it related to Variance and Bias of an estimator? How to compute?
4. What is an MVUE?
5. How to show one estimator is better than another?
6. What is a sufficient statistic? Intuitively? Mathematically? How to use the factorization method to show sufficiency?
7. Method of moments. How to use it estimate one or more parameters.

8. Maximum likelihood esimators (MLE). How to compute them. Why taking the logarithm makes things easier (also useful in numerics and semi-definite programing for the comp sci folks)

9. What is a confidence interval? How do you interpret it?

10. Pivotal quantities. What are they? How to use them to calculate confidence intervals

11. How to use the CLT to get confidence intervals for large sample sizes.

12. How to estimate the size of a confidence interval for mean of a Binomial

13. How to use t-distribution to get a confidence interval for the mean when the sample size is not large

14. How to estimate difference in means of two populations

15. Confidence interval for the variance of a normal sample

16. **DO NOT need to know how to estimate confidence intervals for the ratio of two variances**