In and Out Activity

Motivation

The theme of this breakout session is "Making a Mathematical Statistics Course More Modern." One of the considerations in making Math Stat more modern is which topics should be included and excluded from the course.

Task

Consider the following list of topics that often appear in a Mathematical Statistics textbook. This list is loosely based on the table of contents from *Mathematical Statistics with Applications* by Wackerly, Mendenhall, and Scheaffer.

Identify 15 topics that you feel must be in a Math Stat course. For the purposes of this exercise, we are assuming that transformations (method of mgfs, cdfs, and inverse functions) have already been covered in the preceding Probability course.

Sampling Distributions
1. Sampling distributions related to the Normal Distribution (e.g., distribution of xbar)
2. Normal distribution theory (relation to Chisq(1), t, etc.)
3. Central Limit Theorem
4. Simulating sampling distributions

Estimation Topics
5. Sufficient statistics
6. Maximum Likelihood Estimation
7. Method of Moments Estimation
8. Bias/Variance/MSE of estimators
9. Consistency
10. UMVUE
11. Cramer-Rao Lower Bound & Asymptotic distribution of MLEs
12. Confidence Intervals using pivots
13. Confidence Intervals using bootstrapping
14. "Conceptual" Confidence Intervals (e.g., what does 95% confidence really mean?)
15. Intro Stat Confidence Intervals

Hypothesis Testing
16. Neyman-Pearson Hypothesis Testing
17. Asymptotic Likelihood Ratio Test
18. Hypothesis Testing rejection regions
19. Permutation tests
20. Intro Stat hypothesis tests
21. Theoretical power and Type I/II Errors
22. Empirical power

Miscellaneous
23. Finite sampling theory (e.g., finite-population correction factor)
24. Order statistics
25. Sample size calculations
26. Inference about variances (tests and intervals)
27. Limit Theorems (e.g., weak LLN and strong LLN)

Advanced Topics
28. Theory of ANOVA
29. Theory of Regression (e.g., proof that standard regression estimators are the best linear unbiased estimators)
30. Bayesian statistics
31. Analysis of categorical data

32. Other: _____