Exam CheckList

November 12, 2019

Check list of topics covered by Midterm 2 (starts with the end part of Ch 5-Ch 9):

1. Delta theorem - scalar + vector versions. Be able to use it in applications
2. Approximation by averages (Bahadur representation) - scalar and vector case
3. Be able to apply Bahadur representation in proofs
4. Bahadur representation of averages of functions with estimated parameters
5. Be able to use CLT, SLLN, WLLN, Slutsky's theorem in practice
6. Theoretical properties of the MLE - strong consistency + AN - be able to prove the results we derived in class
7. Wald test: be able to derive its null asy disn'n. Application of Wald to problems
8. Score test + asy null dist'n: be able to prove in general lines (focus on the key steps; no need to remember the exact Bahadur representation of $\widetilde{\theta}-\theta_0$). Application of the score test to problems
9. Likelihood ratio test+ asy null dist'n: be able to prove in general lines (focus on the key steps; no need to remember the exact Bahadur representation of $\widetilde{\theta}-\widehat{\theta}$). Application
10. What is the appeal of using Wald test? And the downside?
11. What is the appeal of using score test (what about minus) ? What are the advantages/ disadvantages of the LRT?
12. What is the asy dist'n of the Wald, Score, LRT for local alternative $\theta_{10}+d/\sqrt{n}$, where $\theta^T = (\theta_1^T, \theta_2^T)$ (without proof).
13. Identify common non-standard situations where MLE theory does not apply
14. What is an M-estimator? Why is it useful to study M-estimation?
15. Application of M estimation to problems.
16. For a given M-estimation problem, define the true value that the M-estimator converges in probability to.
17. What is the asy distribution of the M-estimator? (no proof)
18. What are the empirical estimators of the asy covariance of the M-estimator?
19. What is the asy distn of the MLE under model misspecification ? What is the implication of estimating the parameter by MLE when the model is incorrectly specified?
20. Application of M-estimation to in linear regression, generalized linear model and so on.
21. What is the asy null distn of the classical tests - Wald, score, LRT - under mode misspecification (no proof needed)?

22. Be able to apply these results to examples.
23. What is the (generalized) Wald statistic? And it's asy null dist'n? Why is this test preferable to the Wald statistic, if the assumed model may be incorrect?
24. What is the disadvantage of the Wald statistic and generalized Wald?
25. What is the form of the generalized score statistic? And its asymptotic null distribution? (no proof required)
26. Is the generalized score test always parameterization invariant (that is: irrespective of the forms of A and B)?
27. Why is Monte Carlo study important?
28. What are basic principles important to use when designing a Monte Carlo experiment?
29. How does the number of simulations used in a Monte Carlo experiment affects accuracy in bias estimation, power estimation, confidence intervals estimation.
30. How to compare two estimators? What is it important to account for when comparing different estimators in the same Monte Carlo study?
31. Is MSE always good to use when assessing performance of estimators?
32. Be able to name few guiding principles in presenting the results?