Exam 1 Topics

BIOE 498/598 PJ

Spring 2021

1. Use the bootstrap to build a null distribution and calculate a p-value.

2. Use and interpret the results of a t-test.

3. **Vocab:** response, predictor, factor, intercept, coefficient, effect size, parameter, residual.

4. Use effect sizes to relate changes in factor levels to changes in the response.

5. Use linear models for hypothesis testing.

6. Explain the meaning of interactions.

7. Calculate the number of interactions in a model with n factors.

8. Explain how transformations affect the relationship between factors and response.

9. Transformations: mean centering, z-scoring, rescaling to compare binary and continuous factors.

10. Apply and interpret the results of a Box-Cox analysis.

11. **Vocab:** run, experiment, experimental unit, replicate, duplicate, background variable, effect, experimental design, confounded factors, biased factors, bias error, random error.

12. Explain the differences between continuous, ordinal, and nominal factors.

13. Apply one-hot encoding to nominal factors.

14. Explain why degeneracy arises in models with an intercept and multilevel factors.

15. Define and interpret contrasts.

16. Determine if a contrast is estimable.

17. Understand and apply blocking factors.

18. Explain the advantages and disadvantages of factorial designs.

19. Calculate the number of runs for a factorial design.

20. Find the degrees of freedom in a model.

21. Explain and interpret half-normal plots.

22. **Vocab:** effect sparsity principle, hierarchical ordering principle, heredity principle.

23. **Vocab:** practical and statistical significance.

24. Fractional Factorial Designs

   - Use generators to derive the defining relation.
   - Use the defining relation to compute confounding structure.

- Compute and interpret the resolution, aberration, and clarity of a design.
- Use foldover and mirror image designs to clear confounded factors.

25. Plackett-Burman Designs

    - Construct PB designs for a set number of factors.
    - **Vocab:** complex aliasing, hidden projection property.
    - Explain how to fit a PB design with a linear model.
    - Interpret the results of subset selection.

26. **Vocab:** mixed-level factorial designs and Orthogonal Arrays.

27. Interpret the 95% CI for effects in a model.

28. Perform power analysis (standard normal and t-test) on model coefficients.

29. Explain the limitations of power analysis.

30. ANOVA

    - Explain the decomposition of the sum of squares for a model.
    - Compute SS_{total}, $SS_{\text{explained}}$, SS_{residual}, and the degrees of freedom for each.
    - Compute the F statistic for an entire model and an individual factor.