Class Notes: Chapters 1&2 – 3 classes

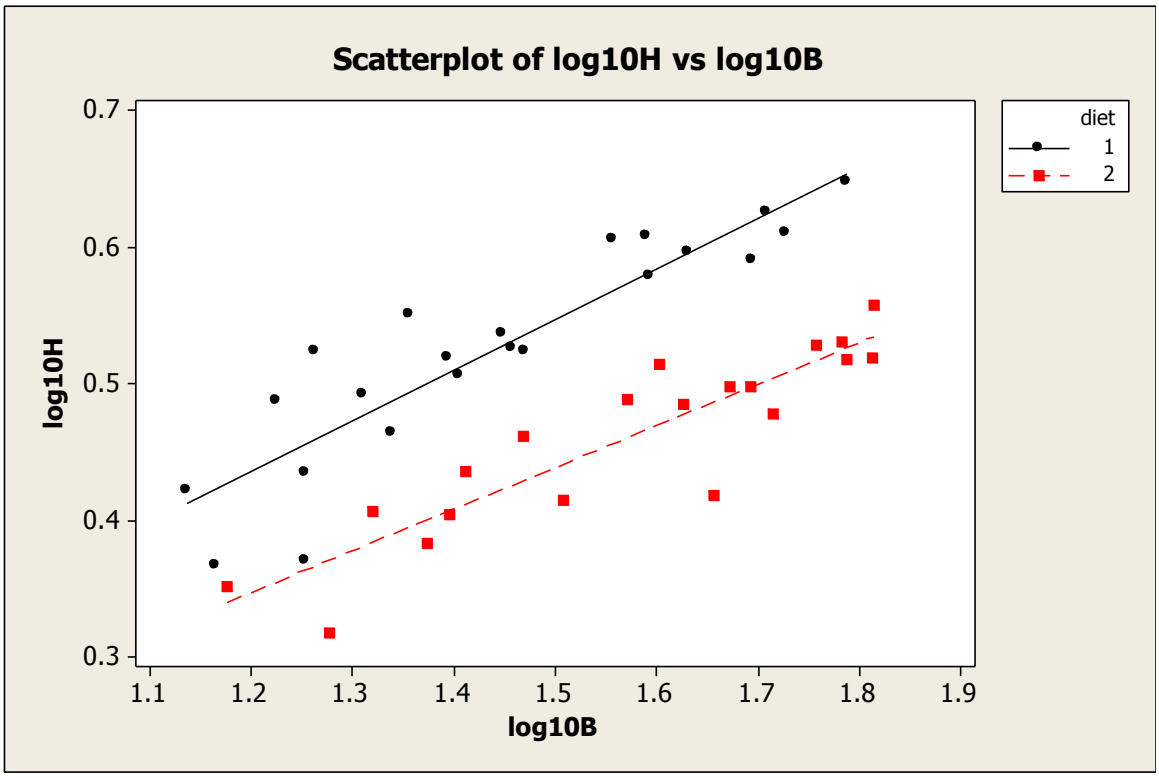
Chapter 1 Review:

- Distributions include parameters that we wish to estimate (CI's) or test (HT's)
- Usual Wald CI paradigm (estimate +/- 2 SE) works well in simple linear cases, but breaks down sometimes (see below)
- Could then use the Wald paradigm on another scale and then "back-transform" – e.g., odds ratio, correlation coefficient, relative risk, etc.
- When the above fails, can use likelihood methods
- SLR where X is a "dummy variable" for one of the treatments is equivalent to the equal-variance two independent sample t-test. This helps us extend to ANOVA and ANOCOV

Chapter 2:

- SLR assumptions – important to consider and validate
- Interpretation of slope parameter estimate is very important (see p.3)
- Ex. 2.2 illustrates transforming both sides of the equation and complication with interpretation of slope in this case
- Parameter estimates (a and b) are random variables and are usually correlated – whence confidence ellipses (p.5)
- MLR: several potential X's can be included, individual t-tests are "one-at-a-time tests" given other X's in the model
- If we want to *simultaneously* drop several X's (and in other cases as well), we must use the Full-and-Reduced F test on p.8 – this test is very important! (Section 2.4)

- **This test is a 'Likelihood Test' and is only valid for NESTED MODELS. What are nested models? It's easy to show that a simple linear model is nested in a simple quadratic model, but sometimes not so easy**
- **Section 2.5: return to dummy variables again with Example 2.4 on p.10. Dummy variables are also needed to perform an analysis of covariance (ANOCOV) as in Ex. 2.5 on p.11: Y = $\log_{10}$(head size) and wish to compare two treatments; the covariate is X = $\log_{10}$(body size)**
- **This graph illustrates the ≈ parallelism detected on p.13;**



- **We really have no business performing an ANOCOV analysis if we cannot accept parallelism; parallelism means that the covariate affects the response variable in a similar manner for the two drugs or groups**
- **Homework 1 - Ex. 1(c) demonstrates the importance of first removing covariate(s) (i.e., doing ANOCOV) before**

comparing means of Y – this as opposed to just doing a simple 2-sample t-test (and ignoring the covariate)

- In the presence of an interaction term, main-effects terms cannot be interpreted and are meaningless

Section 2.6 Material

- Sometimes the Wald procedure on a transformed scale yields reliable CI's, and sometimes we have to go to the trouble to find the more reliable likelihood-based CI's
- Examples include ρ = CC (correlation coefficient) even when normality is assumed, and also π, OR, and RR (these latter 3 are in the Appendix)
- Fisher showed a good transformed scale for the CC (r) is the inverse hyperbolic tangent, k = ½log{(1+r)/(1-r)}, from which we get the CI given in equation (2.8)
- For the CC, the likelihood-based CI is given in (2.10)
- For the original Efron GPA data graphed on p.15 (*n=15*), these two intervals are close (top of p.16) for both 95% and 99%, and graphs in mid-p.16 are close
- This approximation breaks down for small samples: note the big difference between the two 95% CI's for data graphed on p.17 (*n=6*) – graphs and intervals differ a lot on p.17;
- When do Wald methods break down? This is a function of the model/data *'curvature'*
- Bottom line: likelihood methods are usually preferred, but finding them is computationally (much) more work

Examples in the Appendix

Again, there exist modified Wald-type intervals which – for large sample sizes – approximate the likelihood intervals