Material Covered

All tests are cumulative, but Test 3 will focus on Sections 6.1–6.8. The following topics were not covered: 6.5.4 (formal definitions of leverage and influence), 6.7.3 (power of t-tests).

Things to be sure you review

This is not intended to be an exhaustive list, but the items below are important things to review.

1. The Simple Linear Model

   - specification of the model.
   - interpretation of the parameters.

2. Linear Models and Linear Algebra

   - The colorful picture and all of the vectors on it.
   - Dot products and projections and how they are used to fit a linear model.
   - Using matrices (especially the model matrix and the hat matrix) in linear models.
   - How ANOVA tables relate to the vectors.
   - Degrees of freedom

3. Inference for linear models

   - $\hat{\beta}_1 \sim \mathsf{Norm}\left(\beta_1, \frac{\sigma}{|\boldsymbol{x}-\overline{x}|}\right)$.
   - $\hat{\beta}_0 \sim \mathsf{Norm}\left(\beta_0, \sigma\sqrt{\frac{1}{|\mathbf{1}|^2} + \frac{\overline{x}}{|\boldsymbol{x}-\overline{x}|}^2}\right)$.
   - $\frac{(n-2)S^2}{\sigma^2} \sim \mathsf{Chisq}(n-2)$.
   - Confidence intervals and p-values involving model parameters.
   - Confidence and prediction intervals for new observations.
   - Using `confint()`, `makeFun()`, `gf_lm()`.
   - F, T, and Chisq distributions and how they arise in the context of linear models.

4. Applying linear models

   - Model formulas and interpretation of parameters.
   - Binary categorical predictors and coding scheme used for them.
   - Transformations (how, why, Tukey's buldge).
   - Fitting linear models with `lm()` and interpreting the output of `summary(model)` and `anova(model)`.

5. Regression diagnostics

   - Residuals and residual plots (`plot()`, `mplot()`).
   - Outliers and influence.
   - Using transformations to improve the model.

6. Logistic regression

   - Specification of the model.
   - The logit transformation and why it is used.
   - Fitting with `glm()`.

- Using `makeFun()` to obtain the model fit function. (Note: By default, `makeFun()` does the back transformation to the probability scale for you.)
- Interpreting parameters, estimates, and model fit.

7. t-tests

  - one-sample, paired, and Welch's 2-sample.
  - derivation of 2-sample test in Fairy Land, and how that becomes the 2-sample t-test. (But you do not need to memorize the formula for degrees of freedom.)
  - `t.test()`
  - relationships between t-tests and linear models.

8. Chi-squared tests for 2-way tables

   These were covered in Chapter 5, so they are covered under the "all tests are cumulative" clause. But they also complete our taxonomy of 2-variable analysis, so you should not forget about them.