Homework 5: Due on Mar. 20

Guideline

- Homework answers to Simulations and data analysis should be written in R Markdown.
- Please find the following exercise question in [HMC] (Hogg, Mckean, and Craig 2018).
- The question is worth of 10 points each.

1. Ex 6.3.1
2. Ex 6.3.2 Power Curve: plot the power for testing $H_0 : \theta = \theta_0$ vs. $H_1 : \theta = \theta_1$, against θ_1.
3. Ex 6.3.17
4. Simple linear regression. [1]
   The `salmon.dat` data (attached) contains 40 annual counts of the numbers of recruits and spawners in a salmon population. The units are thousands of fish. Recruits are fish that enter the catchable population. Spawners are fish that are laying eggs.

   The classic Beverton-Holt model for the relationship between spawners and recruits is

   $$\frac{1}{R} = \beta_0 + \beta_1 \frac{1}{S},$$

   where R and S are the numbers of recruits and spawners, respectively.

   Please fit a linear regression model using the transformed data $\frac{1}{R}$ and $\frac{1}{S}$ to estimate β_0 and β_1. And test whether the two coefficients are positive. (They should be nonnegative by theory.)
5. Please refit linear regression on the SAT data discussed in class to include other predictors. Use `data(sat, package="faraway")` in R to load data.

   (a) Please include "ratio" (average pulp/teacher) and "salary" (average annual salary of teachers) into your model. Explain the estimated coefficient table with t-tests in the context.

   (b) The "ratio" is a very right-skewed variable. Instead of using it as a continuous predictor, please convert it into a categorical variable using

   `catratio=cut(ratio,breaks=c(13,16,18,25)` .

   Please interpret the estimated intercept and the coefficients for the new categorical variable in the context.

   (c) Are the conclusions for (a) and (b) the same? Please comment on the comparison.

[1] Source: Givens and Hoeting (2012), Computational Statistics, 2nd Ed., Ex. 9.4