Week 15. Page 275. Question 17 Page 276. 2, redo 9. Page 279. 17 Page 316. 10 Page 331. 2, 3

A1. a. Generate data for a replicated 2² FD, with model $Y = 1 + 2A + 3B + 4A * B + \epsilon$, where $A = \pm 1, ..., \epsilon \sim bin(1, 0.1) - 0.1$.

- b. Compute the effects based on data.
- c. Given the relation between the LSE of intercept in $lm(y \sim factor(A) + factor(B) + factor(A * B))$ and the LSEs in $lm(y \sim A * B)$). Verify through your data explicitly.
- d. Based on the model in part a, design a test for H_0 : main effect of A is 4 v.s. H_1 : H_0 is false, with a level of $\alpha = 0.05$.
 - Repeat the test 100 times and compare the $\hat{P}(H_1|H_0)$ to α .

Can we estimate $P(H_0|H_1)$ through the previous 100 simulation results ?

e. Test H_0^2 : $y = \mu + \epsilon$ v.s. H_1^2 : $y \neq \mu + \epsilon$. using the previous simulation data in part d (also repeat 100 times).

Can we compute $P(H_1^2|H_0^2)$ and $P(H_0^2|H_1^2)$ for the test you set ? Can we estimate $P(H_1^2|H_0^2)$ and $P(H_0^2|H_1^2)$ through results of part e ?

A2. Given model

$$\begin{split} Y &= \beta_0 + \beta_1 X + \beta_2 Z + \beta_3 X * Z + \epsilon, \text{ where } X, Z \in \{-1, 1\}, \\ \text{solve for the parameters } \vec{\alpha} \text{ and } \vec{\gamma} \\ \text{the functions of } \vec{\beta} \text{ in the following two models:} \\ Y &= \alpha_0 + \alpha_1 \mathbf{1}(X = 1) + \alpha_2 \mathbf{1}(Z = 1) + \alpha_3 \mathbf{1}(X * Z = 1) + \epsilon, \text{ or} \\ Y &= \alpha_0 + \alpha_1 factor(X) + \alpha_2 factor(Z) + \alpha_3 factor(X * Z) + \epsilon, \\ Y &= \gamma_0 + \gamma_1 \mathbf{1}(X = 1) + \gamma_2 \mathbf{1}(Z = 1) + \gamma_3 \mathbf{1}(X = Z = 1) + \epsilon \text{ or} \\ Y &= \gamma_0 + \gamma_1 factor(X) + \gamma_2 factor(Z) + \gamma_3 factor(X) factor(Z) + \epsilon. \\ \mathbf{Hint: There are no data here.} \end{split}$$