HW 5

Exercise 5.1 (Reality TV and cosmetic surgery)**.** (Refer to Page 201 Question 4.30 and Page 236 Question 4.68, Data set: BDYIMG)

(Page 201 Question 4.30) Refer to the *Body Image: An International Journal of Research* (March 2010) study of the impact of reality TV shows on a college student's decision to undergo cosmetic surgery (Exercise 4.12 p. 189). Recall that the data for the study (simulated based on statistics reported in the journal article) are saved in the file. Consider the interaction model, $E(y) = \beta_0 + \beta_1 x_1 + \beta_2 x_4 + \beta_3 x_1 x_4$, where

- y: desire to have cosmetic surgery (25-point scale)
- x_1: {1 if male, 0 if female}
- x_4: impression of reality TV (7-point scale).

The model was fit to the data and the resulting printout appears below.

a. Give the least squares prediction equation.
b. Find the predicted level of desire (y) for a male college student with an impression-of-reality-TV-scale score of 5.
c. Conduct a test of overall model adequacy. Use $\alpha = 0.10$.
d. Give a practical interpretation of R_a^2.
e. Give a practical interpretation of s.
f. Conduct a test (at $\alpha = 0.10$) to determine if gender (x_1) and impression of reality TV show (x_4) interact in the prediction of level of desire for cosmetic surgery (y).

Table 1: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.670	.449	.439	2.350

Table 2: ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	747.001	3	249.000	45.086	0.000
	Residual	916.787	166	5.523		
	Total	1663.788	169			

Table 3: Coefficients

Model		Unstandardized Beta	Unstandardized Std. Error	Standardized Beta	t	Sig.
1	(Constant)	11.779	0.674		17.486	0.000
	GENDER	-1.972	1.179	-0.303	-1.672	0.096
	IMPREAL	0.585	0.162	0.258	3.617	0.000
	GENDER_IMPREAL	-0.553	0.276	-0.378	-2.004	0.047

- Predictors: (Constant), GENDER_IMPREAL, IMPREAL, GENDER
- Dependent Variable: DESIRE

(Page 236 Question 4.68) Recall that psychologists modeled desire to have cosmtic surgery (y) as a function of gender (x_1), self-esteem (x_2), body satisfaction (x_3), and impression of reality TV (x_4). The psychologists theorized that one's impression of reality TV will "moderate" the impact that each of the first three independent variables has on one's desire to have cosmetic surgery. If so, then x_4 will interact with each of the other independent variables.

a. Give the equation of the model for $E(y)$ that matches the theory.
b. Fit the model, part a, to the simulated data saved in the file.
c. Give the null hypothesis for testing the psychologists' theory.
d. Conduct a nested model F-test to test the theory. What do you conclude?

Exercise 5.2 (Commercial refrigeration systems)**.** (Question 4.40 on Page 209) The role of maintenance in energy saving in commercial regrigeration was the topic of an article in the *Journal of Quality in Maintenance Engineering* (Vol. 18, 2012). The authors provided the following illustration of data relating the efficiency (relative performance) of a refrigeration system to the fraction of total charges for cooling the system required for optimal performance. Based on the data shown in the graph, hypothesize an appropriate model for relative performance (y) as a function of fraction of charge (x). What is the hypothesized sign (positive or negative) of the β_2 parameter in the model?

Fraction of charge for optimal performance
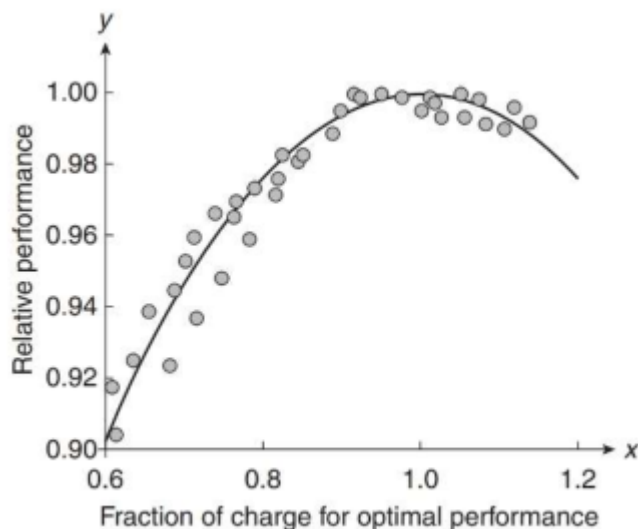
Exercise 5.3 (Shopping on Black Friday). (Page 210 Question 4.44, Data set: BLKFRIDAY)

The *International Journal of Retail and Distribution Management* (Vol. 39, 2011) published a study of shopping on Black Friday (the day after Thanksgiving). Researchers conducted interviews with a sample of 38 women shopping on Black Friday to gauge their shopping habits. Two of the variables measured for each shopper were age (x) and number of years shopping on Black Friday (y). Data set is BLKFRIDAY.

    a. Fit the quadratic model, $E(y) = \beta_0 + \beta_1 x + \beta_2 x^2$. Given the prediction equation.
    b. Conduct a test of the overall adequacy of the model. Use $\alpha = 0.01$.
    c. Conduct a test to determine if the relationship between age (x) and number of years shopping on Black Friday (y) is best represented by a linear or quadratic function. Use $\alpha = 0.01$.

Exercise 5.4 (Homework assistance for accounting students). (Refer to Page 228 Question 4.58, Data set: ACCHW)

- Questions 4.58 (a) – (c)