Data Analysis Exercises for Chapter 13: *Applied Regression Analysis, Generalized Linear Models, and Related Methods, Third Edition* (Sage, 2016)

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Exercise D13.1 Find variance-inflation factors for the slope coefficients of the regression model that you fit in Exercise D5.5. Does collinearity appear to be a serious problem in this model? If so, is there anything reasonable that can be done about it?

Exercise D13.2 * Use generalized variance inflation factors to examine the impact of collinearity on the precision of estimation for the dummy-regression model that you fit in Exercise D7.1 (a). (If the model that you fit in Exercise D7.1 (a) had only a dichotomous factor, first pick another problem with a polytomous factor.)

Exercise D13.3 * The data that follow were constructed by Mandel (1982) to illustrate the problem of collinearity:

X_1	X_2	Y
16.85	1.46	41.38
24.81	−4.61	31.01
18.85	−0.21	37.41
12.63	4.93	50.05
21.38	−1.36	39.17
18.78	−0.08	38.86
15.58	2.98	46.14
16.30	1.73	44.47

(a) Compute the mean and standard deviation of each variable. Find the correlations among X_1, X_2, and Y, and use these correlations to calculate the standardized coefficients B_1^* and B_2^* for the regression of Y on X_1 and X_2. Find the unstandardized coefficients A, B_1, and B_2.

(b) Perform a principal-components analysis for X_1 and X_2. Draw the geometric vector representation of the principal-components analysis. Find the variance-inflation factors for the coefficients B_1 and B_2, and calculate the condition number K for the regression.

(c) Use the second principal component to approximate the near-collinear relation between the standardized regressors Z_1 and Z_2. Express this relation as a linear relationship between the unstandardized regressors X_1 and X_2.

(d) Now regress X_1 on X_2. How does the fitted regression equation compare with the linear relationship found in part (c).

(e) Draw the data ellipse for X_1 and X_2, and the 95 percent joint confidence ellipse for B_1 and B_2.

Exercise D13.4 * Perform a principal-components analysis for the explanatory variables in the regression model that you fit in Exercise D5.5. What do you learn from this analysis about the correlational structure of the explanatory variables?