Homework 3
BIOST 515
Due: January 29, 2003 in lab

1. The data for this problem and parts of the question are from Neter, Kutner, Nachtsheim and Wasserman, 4th ed. The data set is available on the class website as patsat.dat.

   A hospital administrator wished to study the relation between patient satisfaction (Y) and patient's age (X1, in years), severity of illness (X2, an index) and anxiety level (X3, an index). The administrator randomly selected 23 patients and collected the data in patsat.dat, where larger values of Y, X2 and X3 are, respectively, associated with more satisfaction, increased severity of illness and more anxiety.

   (a) Obtain the scatterplot matrix and the correlation matrix. Interpret these and state your principal findings.

   (b) Fit the regression model,

   $$Y_i = \beta_0 + \beta_1 X1_i + \beta_2 X2_i + \beta_3 X3_i + \epsilon_i,$$

   to the data and state the estimated regression function. How is $\hat{\beta}_2$ interpreted here?

   (c) Test whether there is a regression relation here; use $\alpha = 0.10$. State the alternatives, decision rule (the rule that determines rejection of the null hypothesis) and conclusion. What does your test imply about β_1, β_2 and β_3?

   (d) Obtain joint 90% interval estimates of β_1, β_2 and β_3. Interpret your results.

   (e) Obtain a 90% confidence interval estimate of mean satisfaction when $X1_0 = 35$, $X2_0 = 45$ and $X3_0 = 2.2$. Interpret your confidence interval.

   (f) Obtain the analysis of variance table that decomposes the regression sum of squares into regression sum of squares associated with X2; with X1 given X2; and with X3 given X2 and X1.

   (g) Test whether $X3$ can be dropped from the regression model given that X1 and X2 are retained. Use the F statistic and $\alpha = 0.025$. State the alternatives, decision rule and conclusion.

   (h) Test whether both $X2$ and $X3$ can be dropped from the model given that $X1$ is retained using $\alpha = 0.025$. State the alternatives, decision rule and conclusion.

   (i) Test whether $\beta_1 = -1.0$ and $\beta_2 = 0$ using $\alpha = .025$. State the alternatives, full and reduced models, decision rule and conclusion.

2. Problem 5, ch. 11 in Kleinbaum, Kupper, Muller and Nizam. In order to receive full credit for this problem, you will need to show your reasoning for parts e and f. For parts c and d, state the null hypothesis in terms of the coefficients, not the partial correlation coefficients. Show your work for a-d.

3. Problem 12, ch. 8 in Kleinbaum, Kupper, Muller and Nizam. For part b also give the 95% confidence interval. For part c, give both the R^2 and the adjusted R^2.

4. Problem 8, ch. 11 in Kleinbaum, Kupper, Muller and Nizam.