17.874
Multivariate Statistics
Spring 2004
Problem Set 3

1. Matrix Exercise.

Consider the matrices:

$$X = \begin{pmatrix} 1 & -1.094 & -1.315 \\ 1 & .367 & -1.480 \\ 1 & .145 & -.104 \\ 1 & .266 & 1.432 \\ 1 & .479 & .342 \\ 1 & -1.234 & .2601 \\ 1 & .301 & -.622 \\ 1 & -1.546 & -.765 \\ 1 & .139 & -.545 \\ 1 & 1.133 & 2.303 \end{pmatrix}$$

$$y = \begin{pmatrix} -.244 \\ 3.877 \\ 1.411 \\ -.477 \\ 2.887 \\ -3.319 \\ 2.951 \\ -.856 \\ .936 \\ .250 \end{pmatrix}.$$

(a) Compute X'X and X'y.

(b) Consider the equations $(X'X)b = X'y$, where b is a column vector with values b_0, b_1, and b_2. Find values of b that satisfy this equation.

(c) Create a small dataset in the STATA editor in which the values of second and third columns of X are Var1 and Var2 the values of the vector y are Var3. Regress Var3 on Var2 and Var1 (i.e., reg Var3 Var2 Var1). What are the slopes and intercept?

(d) After running your regression you can find stored information with the following command: matrix list e(matname). For example you can retrieve the vector of b's using matrix list e(b). You can retrieve the variance-covariance matrix of the b's using matrix list e(V).

2. Matrix Differentiation.

What is the Jacobian for the following transformations?

(a) $y_1 = \frac{X_1}{X_2}$

(b) $ln(y_2) = ln(X_1) - ln(X_2) + 2ln(X_3)$.

(c) $y_3 = X_1 X_2 X_3$.