Homework #1, due Friday, February 24, 2006

1. Consider two matrixes: A, $m \times n$, and B, $n \times p$. Prove that their product, AB can be written:

   $AB = \sum_{i=1}^{n} A_i B^i$.

   How could we write $X'X$?

2. Prove that the commutative law of mulitplication applies to diagonal matrixes. What is the inverse of a diagonal matrix?

3. Consider the sum $\sum_{i=1}^{n}(X_i - \overline{X})(Y_i - \overline{Y})$, where X_i, Y_i are scalars.

   (a) Please write the sum in matrix notation, using no sums. (Hint: use M_0).

   (b) Use the matrix notation and facts you know about M_0 to prove:

$$\sum_{i=1}^{n}(X_i - \overline{X})(Y_i - \overline{Y}) = \sum_{i=1}^{n}(X_i - \overline{X})Y_i$$
$$= \sum_{i=1}^{n} X_i(Y_i - \overline{Y})$$

   and that $\sum_{i=1}^{n}(X_i - \overline{X})(Y_i - \overline{Y}) = \sum_{i=1}^{n} X_i Y_i$
   if either the mean of X or the mean of Y is zero.