

## Econ 741 (Spring 2003): Suggested Answer for Homework 2

1. < Proof of (1.2.9) on page 19 >

$P' = [X(X'X)^{-1}X']' = X(X'X)^{-1}X' = P$ . Thus  $P$  is symmetric. Since  $I_n$  and  $P$  are symmetric,  $M (= I_n - P)$  is also symmetric.

$P^2 = [X(X'X)^{-1}X'] [X(X'X)^{-1}X'] = X(X'X)^{-1}X' = P$ ,  $P$  is idempotent.

$M^2 = [I_n - P][I_n - P] = I_n - 2P + P^2 = I_n - P = M$ ,  $M$  is also idempotent.

2. < Proof of (1.2.10) on page 19 >

$PX = [X(X'X)^{-1}X']X = X$ . Thus,  $P$  is the projection matrix

3. < Proof of (1.2.11) on page 19 >

$MX = (I_n - P)X = X - PX = X - X = 0$ . Thus,  $M$  is the annihilator.