Exercise #27  
**Sweep Operator for Linear Regression Model**

Use IML function SWEEP to implement linear regression model (ordinary least squares) and test on it with a data set. For $n \times k$ model matrix $X$, suppose matrix $A$ contains

$$\begin{bmatrix}
X'X & X'Y \\
Y'X & Y'Y
\end{bmatrix}.$$  

Let $D$ be $1 \times k$ row vector $[1 \ 2 \cdots k]$. Then $C = \text{SWEEP}(A, D)$ contains

$$\begin{bmatrix}
(X'X)^{-1} & (X'X)^{-1}X'Y \\
-Y'X(X'X)^{-1} & Y'(I - X(X'X)^{-1}X')Y
\end{bmatrix}.$$  

The partitions of $C$ form the beta values, $SS_E$, and a matrix proportional to the covariance of the beta values for the least squares estimates of $\beta$ in the linear model

$$Y = X\beta + \varepsilon$$