Problems 1
Prove the following ordering among the values of Pillai’s trace, Wilk’s lambda and Hotelling-Lawley trace,

\[ \sum_{j=1}^{p} \frac{\lambda_j}{1 + \lambda_j} \leq \log \prod_{j=1}^{p} (1 + \lambda_j) \leq \sum_{j=1}^{p} \lambda_j, \]

where \( \lambda_j; j = 1, \ldots, p \) are eigenvalues of \( BE^{-1} \), and \( B \) and \( E \) are two independent \( p\)-dimensional Wishart r.v.s as defined in the lecture.

Problems 2
In a multivariate regression model,

\[ Y = XB + \epsilon = X(1)B(1) + X(2)B(2) + \epsilon, \]

where \( X = (X(1), X(2)) \), and \( B = \begin{pmatrix} B(1) \\ B(2) \end{pmatrix} \). Denote

\[ X'X = \begin{pmatrix} X'(1)X(1) & X'(1)X(2) \\ X'(2)X(1) & X'(2)X(2) \end{pmatrix} = \begin{pmatrix} A_{11} & A_{12} \\ A_{21} & A_{22} \end{pmatrix}, \]

and \( X'Y = \begin{pmatrix} X'(1)Y \\ X'(2)Y \end{pmatrix} = \begin{pmatrix} C_1 \\ C_2 \end{pmatrix} \).

Show that \( \hat{B}(1) = (A_{11} - A_{12}A_{22}^{-1}A_{21})^{-1}(C_1 - A_{12}A_{22}^{-1}C_2) \).

Problem 3 from textbook:

Exercise 7.26(b)