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ECONOMICS 7330 – Probability and Statistics, Fall 2025

Homework 9. Due Wednesday November 24.

1. (24% of a previous exam)
a) Assume you have estimated 3 parameters, with estimates $\hat{\beta}_1 = 7$, $\hat{\beta}_2 = 9$, and $\hat{\beta}_3 = 11$, and assume that you know for sure the estimates are normally distributed and the known variance-covariance matrix is

$$\Sigma = \begin{pmatrix} 5 & 1 & 0 \\ 1 & 3 & 1 \\ 0 & 1 & 4 \end{pmatrix} .$$

a) Write down a (Wald) test statistic for $\beta_2 = 0$. (I want you to write the answers as a scalar, a real number. Same for the other questions)
b) Write down a (Wald) test statistic for $\beta_2 + \beta_3 = 1$.
c) What is the distribution of the test statistic you wrote down in part b)? (Be clear about whether you are talking about an asymptotic test of not in this and the following.)
d) Write down a test statistic for (β_2, β_3)=(2,1).
e) What is the distribution of the test statistic you wrote down?
f) Write down a test statistic for the hypothesis $\log(\beta_1) - \beta_3^2 = 2$. (Again, I need to see the numbers.)
g) Assuming the coefficients are consistent, what is the distribution of the test statistic you wrote down? (Is it an exact or asymptotic distribution?)