Name: ____________________

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ECONOMETRICS - 11-06-2021 - Time: 2 h 30'

1. Say if the following statements are unambiguously true (True), unambiguously false (False) or impossible to classify the way they are stated (Not necessarily). Write the motivations to your answers **only** in the space provided. A "Not necessarily" answer with no adequate motivation will be considered wrong.

   (a) The matrix $\begin{bmatrix} 1 & 1 \\ 0 & 0 \end{bmatrix}$ is idempotent.

   True ◯ False ◯ Not necessarily ◯

   (b) The matrix $\begin{bmatrix} 1 & 1 \\ 0 & 0 \end{bmatrix}$ cannot be a covariance matrix.

   True ◯ False ◯ Not necessarily ◯

   (c) An estimator whose variance goes to 0 as $n \to \infty$ is consistent.

   True ◯ False ◯ Not necessarily ◯

   (d) The centred R^2 index is always larger than its uncentred counterpart.

   True ◯ False ◯ Not necessarily ◯

   (e) Given the model $y_i = \beta_0 + \beta_1 x_i + \beta_2 x_i^2 + \varepsilon_i$, where x_i is a nonnegative variable, if $\beta_2 < 0 < \beta_1$, then there may be two observations for which the marginal effect of x_i has opposite signs.

   True ◯ False ◯ Not necessarily ◯

2. Suppose you have a consistent and asymptotically normal estimate of the two parameters θ and ψ, as follows:

$$\begin{bmatrix}\hat{\theta}\\ \hat{\psi}\end{bmatrix} = \begin{bmatrix}0.9\\ 2.4\end{bmatrix} \qquad V = \begin{bmatrix}0.36 & 0.16\\ 0.16 & 0.64\end{bmatrix}$$

where V is the asymptotic variance estimator. Now test the following hypotheses:

(a) $H_0 : \theta = 0$

Test type: ______ Distribution: ______ Test statistic: ______
Decision: ○ Reject ○ Don't reject

(b) $H_0 : \psi = 0$

Test type: ______ Distribution: ______ Test statistic: ______
Decision: ○ Reject ○ Don't reject

(c) $H_0 : \psi = \theta$

Test type: ______ Distribution: ______ Test statistic: ______
Decision: ○ Reject ○ Don't reject

(d) $H_0 : \psi = \theta = 1$

Test type: ______ Distribution: ______ Test statistic: ______
Decision: ○ Reject ○ Don't reject

3. Table 1 contains a model for imports of goods and services in the Euro area from 1995 to 2020 (quarterly data from Eurostat).

OLS, using observations 1995:3–2020:4 (T = 102), dependent variable: m_t

	Coefficient	Std. Error	t-ratio	p-value
const	−0.6712	0.3795	−1.7687	0.0801
time	0.0005	0.0002	2.8823	0.0049
m_{t-1}	0.8492	0.0565	15.0427	0.0000
y_t	1.5177	0.0693	21.8843	0.0000
y_{t-1}	−0.7477	0.1192	−6.2747	0.0000
y_{t-2}	−0.4878	0.0721	−6.7621	0.0000

Mean dependent var	4.344858	S.D. dependent var	0.289279
Sum squared resid	0.013285	S.E. of regression	0.011764
R^2	0.998428	Adjusted R^2	0.998346
$F(5, 96)$	12196.05	P-value(F)	6.9e–133
Log-likelihood	311.5199	Akaike criterion	−611.0397
Schwarz criterion	−595.2899	Hannan–Quinn	−604.6621
$\hat{\rho}$	−0.043062	Durbin's h	−0.529363

LM test for autocorrelation up to order 8:
Test statistic: LMF = 1.50009 (p-value = 0.168691)

Table 1: ADL model for imports in the Euro Area

Variable name	Description
m_t	log imports of goods and services (real)
y_t	log GDP (real)

Answer the following questions, using the numerical estimates that you find in table 1:

(a) Rewrite the model in ECM form:

$\Delta m_t =$

(b) Do we have an autocorrelation problem in this model? Motivate your answer.

(c) Calculate the first 3 impact multipliers:

$\delta_0 =$ ______ $\delta_1 =$ ______ $\delta_2 =$ ______

(d) Calculate the long-run elasticity of imports with respect to GDP:

$c = \sum_{j=0}^{\infty} \delta_j =$ ______

(e) Do the signs and magnitudes of the estimated multipliers conform to your economic intuition? Motivate your answer.