

Name: \_\_\_\_\_

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**ECONOMETRICS - 2022-09-16 - 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  $\begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix}$  is equal to its inverse.

True ☐ False ☐ Not necessarily ☐

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(b) Suppose you have a sequence of random variables  $Y_n = X_n + Z$ , where  $X_n \xrightarrow{p} 0$  and  $Z \sim N(0, 1)$ . Then  $Y_n \xrightarrow{d} N(0, 1)$ .

True ☐ False ☐ Not necessarily ☐

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(c) The uncentred  $R^2$  index can never be outside the  $[0, 1]$  interval.

True ☐ False ☐ Not necessarily ☐

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(d) The centred  $R^2$  index can never be outside the  $[0, 1]$  interval.

True ☐ False ☐ Not necessarily ☐

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(e) The sum of squared residuals for an ECM model is always smaller than the one for the corresponding ADL model.

True ☐ False ☐ Not necessarily ☐

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2. For the model

$$y_i = \beta_0 + \beta_1 x_i + \varepsilon_i$$

you have the following moment matrices:

$$y'y = 1803.6 \quad X'y = \begin{bmatrix} 72 \\ -60 \end{bmatrix} \quad X'X = \begin{bmatrix} 120 & -40 \\ -40 & 160/3 \end{bmatrix}$$

Answer the following questions:

(a) Determine the sample size:

$$n = \underline{\hspace{2cm}}$$

(b) Compute the OLS estimates:

$$\hat{\beta}_0 = \underline{\hspace{2cm}} \quad \hat{\beta}_1 = \underline{\hspace{2cm}}$$

(c) Compute an estimate of the variance of  $\varepsilon_i$ :

$$\hat{\sigma}^2 = \underline{\hspace{2cm}}$$

(d) Test the hypothesis  $H_0 : \beta_1 = 0$

Test type:  Distribution:  Test statistic:   
 Decision: ☐ Reject ☐ Don't reject

(e) Test the hypothesis  $H_0 : \beta_0 + \beta_1 = 0$

Test type:  Distribution:  Test statistic:   
 Decision: ☐ Reject ☐ Don't reject

3. The Indian data scientist Sourav Banerjee collected a dataset on 4746 lease offers for apartments in India between 13/04/2022 and 11/07/2022.<sup>1</sup> The variables we use here are:

Variable	Description	Mean	Median	S.D.	Min	Max
l.Rent	Log of Rent in Indian Rupees	9.878	9.680	0.937	7.090	15.068
l.Size	Log of Size of apartment in square metres	6.666	6.745	0.709	2.303	8.987
SemiFurnished	Dummy: is the flat partially furnished?	0.474	0.000	0.499	0.000	1.000
Furnished	Dummy: is the flat furnished?	0.143	0.000	0.350	0.000	1.000
BHK	Number of rooms (Bedrooms + Hall + Kitchen)	2.084	2.000	0.832	1.000	6.000
week	progressive indicator of week (0 = 13/04/2022, 13 = 06/07/2022)	7.916	8.000	3.181	0.000	13.000

The model in Table 1 was estimated by OLS. Now answer the following questions:

<sup>1</sup>See <https://www.kaggle.com/datasets/iamsouravbanerjee/house-rent-prediction-dataset>.

OLS, using observations 1–4746  
 Dependent variable: l\_Rent  
 Heteroskedasticity-robust standard errors, variant HC1

	Coefficient	Std. Error	<i>t</i> -ratio	p-value
const	6.9652	0.0981	71.0085	0.0000
l_Size	0.2047	0.0173	11.8195	0.0000
SemiFurnished	0.1777	0.0218	8.1664	0.0000
Furnished	0.5721	0.0357	16.0441	0.0000
BHK	0.5216	0.0181	28.8686	0.0000
week	0.0373	0.0031	12.0274	0.0000
Mean dependent var	9.878141	S.D. dependent var		0.936642
Sum squared resid	2361.174	S.E. of regression		0.705789
$R^2$	0.432790	Adjusted $R^2$		0.432191
$F(5, 4740)$	556.2120	P-value( $F$ )		0.000000

RESET test: 63.3973,  $p$ -value = 6.7432e-28  
 White's test: 269.259,  $p$ -value = 2.3832e-47

Table 1: Model for the rent of an Indian apartment

- (a) Comment on the size and magnitude of the estimated coefficients. Do they match your economic intuition?

l\_Size:

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week:

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Other variables:

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- (b) Test the hypothesis that the elasticity of rent to size is 1 and provide an economic interpretation of the result:

Test type: \_\_\_\_\_ Distribution: \_\_\_\_\_ Test statistic: \_\_\_\_\_

Decision: ☐ Reject ☐ Don't reject

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- (c) Comment on the diagnostic tests:

RESET:

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White:

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