

Name: _____

Matricola: _____ email: _____

ECONOMETRICS - 21-09-2018 - 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 motivations will be considered wrong.

(a) A matrix full of zeros is invertible if and only if it is square.

True ☐

False ☐

Not necessarily ☐

(b) Let X be a random variable whose support is the interval $[-a/2, a/2]$ and whose density function is $f(x) = \frac{1}{a}$; then $E[X] = 0$.

True ☐

False ☐

Not necessarily ☐

(c) Let X be a random variable whose support is the interval $[-a/2, a/2]$ and whose density function is $f(x) = \frac{1}{a}$; then $E[X^2] = 0$.

True ☐

False ☐

Not necessarily ☐

(d) If $X_n \xrightarrow{P} X$, then $P(X_n > 0)$ is approximately equal to $P(X > 0)$ if n is large.

True ☐

False ☐

Not necessarily ☐

(e) If the Godfrey test is rejected for a model estimated by OLS, then we have heteroskedasticity.

True ☐

False ☐

Not necessarily ☐

2. Suppose you have the following model

$$y_i = \beta_0 + \beta_1 x_i + \beta_2 z_i + \varepsilon_i;$$

you estimate it on a sample of 100 observations under different restrictions, and these are the results you get:

Restriction	Sum of squared residuals
None	17.4583
$\beta_1 = 1$	18.544
$\beta_2 = 1$	18.089
$\beta_1 = \beta_2$	19.037
$\beta_1 = \beta_2 = 1$	19.067

(a) Test the hypothesis $\beta_1 = 1$;

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

(b) Test the hypothesis $\beta_2 = 1$;

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

(c) Test the hypothesis $\beta_1 = \beta_2$;

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

(d) Test the hypothesis $\beta_1 = \beta_2 = 1$;

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

(e) Are there any contradictions among the results of your tests? Discuss in the space below

3. The following model was estimated on a sample of 1000 US workers:

$$w_i = \beta_0 + \beta_1 g_i + \beta_2 e_i + \beta_3 x_i + \beta_4 e_i^2 + \beta_5 x_i^2 + \varepsilon_i$$

where

- w_i is the wage for individual i in US\$;
- g_i is a dummy variable: 1 for female, 0 for male;
- e_i is the individual's education, in years;
- x_i is the individual's work experience, in years.

The estimates are as follows:

Dependent variable: w_i
Heteroskedasticity-robust standard errors, variant HC1

	Coefficient	Std. Error	<i>t</i> -ratio	p-value
β_0	-0.964930	4.17641	-0.2310	0.8173
β_1	-4.17398	0.717022	-5.821	0.0000
β_2	-0.300143	0.595585	-0.5039	0.6144
β_3	0.753581	0.0831552	9.062	0.0000
β_4	0.0884041	0.0228024	3.877	0.0001
β_5	-0.0110523	0.00148947	-7.420	0.0000

Mean dependent var	20.61566	S.D. dependent var	12.83472
Sum squared resid	120981.5	S.E. of regression	11.03231
R^2	0.264842	Adjusted R^2	0.261144
$F(5, 994)$	61.37812	P-value(F)	8.11e-56

- (a) Is it legitimate to say that female workers get lower wages than male workers with the same education and experience? Motivate your answer.

- (b) Estimate the wage for a male worker with 3 years of experience and 15 years of education.

$$\hat{w} = \underline{\hspace{2cm}}$$

- (c) Estimate the marginal effect of education on wage for a male worker with 3 years of experience and 15 years of education.

$$\frac{\partial w_i}{\partial e_i} = \underline{\hspace{2cm}}$$

- (d) Estimate the marginal effect of experience on wage for a male worker with 3 years of experience and 15 years of education.

$$\frac{\partial w_i}{\partial x_i} = \underline{\hspace{2cm}}$$