Name: _____

Matricola: _____ email: _____

ECONOMETRICS - 18/09/2019 - 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) If a the $(n \times k)$ matrix $\mathbf{X}$ has rank k, then $\mathbf{X}'\mathbf{X}$ is invertible.

   True ◯ False ◯ Not necessarily ◯

   (b) If $X_n \xrightarrow{\text{d}} Y$, where Y is a χ^2_1 variable, then $\lim_{n\to\infty} P(X_n > 0) < 1$

   True ◯ False ◯ Not necessarily ◯

   (c) If $X \sim N(0,1)$ then $E(X^2) > 0$.

   True ◯ False ◯ Not necessarily ◯

   (d) The Durbin-Watson statistic is not a test for heteroskedasticity.

   True ◯ False ◯ Not necessarily ◯

   (e) If the dynamic multipliers for an ADL model are all positive, then the long run multiplier must be positive too.

   True ◯ False ◯ Not necessarily ◯

2. Suppose you have two dummy variables x_i and y_i, observed over 400 cases, with the following distribution:

	$x_i = 0$	$x_i = 1$	Total
$y_i = 0$	150	50	200
$y_i = 1$	50	150	200
Total	200	200	400

Now estimate the following model by OLS:

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

(a) Write the OLS estimate for the β parameters:

$\beta_0 =$ _____ $\beta_1 =$ _____

(b) Write the variance estimate:

$\hat{\sigma}^2 =$ _____

(c) Write the estimated covariance matrix for $\hat{\boldsymbol{\beta}}$:

$$\hat{V} = \begin{bmatrix} & \\ & \end{bmatrix}$$

(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

(f) Estimating the model $\log y_i = \beta_0 + \beta_1 \log x_i + \varepsilon_i$ is impossible. Why?

(g) Estimating the model $y_i = \beta_0 + \beta_1 x_i + \beta_2 x_i^2 + \varepsilon_i$ is impossible. Why?

3. Table 1 shows a model in which the dependent variable, `bwght` is the weight in grams of a baby at birth. The sample contains 1709 observations and explanatory variables are:

Name	**Description**
`male`	dummy, 1 if baby is male
`fage`	father's age, years
`mage`	mother's age, years
`cigs`	average cigarettes per day during pregnancy
`drink`	average drinks per week during pregnancy

Dependent variable: bwght

	Coefficient	Std. Error	t-ratio	p-value
const	3191.9172	91.8092	34.7669	0.0000
male	85.6654	27.4685	3.1187	0.0018
fage	7.6202	3.3426	2.2797	0.0227
mage	−1.9713	4.0302	−0.4891	0.6248
cigs	−10.9632	3.4103	−3.2147	0.0013
drink	−5.5459	48.1796	−0.1151	0.9084

Mean dependent var	3409.150	S.D. dependent var	570.3067
Sum squared resid	5.46e+08	S.E. of regression	566.3591
R^2	0.016683	Adjusted R^2	0.013796
$F(5, 1703)$	5.778581	P-value(F)	0.000027
Log-likelihood	−13255.70	Akaike criterion	26523.40
Schwarz criterion	26556.07	Hannan–Quinn	26535.49

White's test for heteroskedasticity: Test statistic: LM = 13.2534, p-value = 0.825349

RESET test for specification: Test statistic: $F(2, 1701) = 2.29406$, p-value = 0.101168

Table 1: Weight of babies at birth

(a) List the variables that are *not* significant at the 5% level:

(b) Comment on the sign and magnitude of the coefficient for the `male` variable:

(c) Comment on the sign and magnitude of the coefficient for the `cigs` variable:

(d) Comment on the White test reported at the end of Table 1.

(e) Comment on the RESET test reported at the end of Table 1.