**Econometrics Test**
2015 - 11 - 12

Name: _____

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1. Say if the following statements are unambiguously true (TRUE), unambiguously false (FALSE) or impossible to classify the way they are stated (CAN'T SAY). Write the motivations to your answers **only** in the space provided. A "CAN'T SAY" answer with no motivations will be considered wrong.

   (a) A non-square matrix cannot be invertible.
   TRUE ◯ FALSE ◯ CAN'T SAY ◯

   (b) if $A$ is a square matrix and $B$ is a square matrix, then $A + B$ is also square.
   TRUE ◯ FALSE ◯ CAN'T SAY ◯

   (c) If $X_n \xrightarrow{\text{p}} 1$, $Y_n \xrightarrow{\text{p}} 0$ and $Z_n = Y_n/X_n$, then $Z_n \xrightarrow{\text{p}} 0$.
   TRUE ◯ FALSE ◯ CAN'T SAY ◯

   (d) In the linear model $\log y_i = \beta_0 + \beta_1 d_i + u_i$, where $d_i$ is a binary variable the coefficient $\beta_1$ may be interpreted as an approximation to the relative difference in $y_i$ when $d_i = 1$ compared to the situation when $d_i = 0$.
   TRUE ◯ FALSE ◯ CAN'T SAY ◯

   (e) In the linear model $y_i = \sum_{j=1}^{k} \beta_j x_{ij} + u_i$, suppose we cannot reject the joint hypothesis $[(\beta_1 = 0) \wedge (\beta_1 = \beta_2)]$. Can we accept the hypothesis $\beta_2 = 0$?
   TRUE ◯ FALSE ◯ CAN'T SAY ◯

2. We have estimated via OLS a model of the form $y_i \simeq \beta_0 + \beta_1 x_{1,i} + \beta_2 x_{2,i}$, on 240 observations. Let the data matrices be as follows:

$$(X'X)^{-1} = 0.001 \begin{bmatrix} 5 & 1 & 2 \\ 1 & 4 & 3 \\ 2 & 3 & 5 \end{bmatrix} \qquad X'y = \begin{bmatrix} 0 \\ -500 \\ 1000 \end{bmatrix} \qquad y'y = 3480$$

Now

(a) Calculate the OLS statistic; $\hat{\beta}' = [\quad , \quad , \quad ]$

(b) Calculate the sum of squared residuals; $SSR =$

(c) Calculate the OLS variance estimator $\hat{\sigma}^2 =$

(d) Is the parameter $\beta_1$ "statistically significant"? YES ◯ NO ◯

(e) Is the parameter $\beta_2$ "statistically significant"? YES ◯ NO ◯

(f) Test the hypothesis $\beta_1 \cdot 4 = \beta_2$

$H_0 : 4\beta_1 - \beta_2 = 0$ $W =$ _____

Decision: ACCEPT ◯ REJECT ◯

3. Consider the model shown in table 1 and provide, on a separate sheet, a comment of the results; the variables used are

| Var. name | Description |
|---|---|
| `micro13` | Crime rate in 2013 |
| `unemp13` | Unemployment rate in 2013 |
| `popres12` | Resident population in 2012 |

Dependent variable: micro13

| | Coefficient | Std. Error | $t$-ratio | p-value |
|---|---|---|---|---|
| const | 11.1734 | 0.868232 | 12.8691 | 0.0000 |
| unemp13 | −0.175879 | 0.0618055 | −2.8457 | 0.0054 |
| popres12 | 0.00902752 | 0.000863641 | 10.4529 | 0.0000 |

| | | | |
|---|---|---|---|
| Mean dependent var | 12.43774 | S.D. dependent var | 5.142974 |
| Sum squared resid | 1184.218 | S.E. of regression | 3.407343 |
| $R^2$ | 0.573603 | Adjusted $R^2$ | 0.561062 |
| $F(3, 102)$ | 45.73794 | P-value($F$) | 8.17e–19 |

White's test for heteroskedasticity –
Test statistic: LM = 4.38763, p-value = 0.624373

Table 1: Crime rates in 104 Italian provinces