UNIVERSITY OF FORT HARE

ECONOMETRICS

ECO 313/E

SUPPLEMENTARY EXAMINATIONS

JUNE / JULY

2025

.....

Time: **3 hours**

Subject: **ECO 313/E**

Marks: **100**

This paper consists of 5 pages including the cover page

Internal Examiners
Prof M Aliber
Ms A Jiza

External Examiners
Prof S Khumalo

INSTRUCTIONS

Read questions carefully.

Answer all questions.

Show all workings.

Use of a non-programmable calculator is permitted.

QUESTION 1 [32]

1.1 The following table gives pairs of dependent and explanatory variables. In each case state whether you would expect the relationship between the two variables to be positive, negative, uncertain, or non-existent (i.e. no relationship). *Give a brief justification in each case.* [8]

Dependent	**Explanatory**
Aggregate consumption of chicken	Unit price of chicken
Individuals' healthcare expenditure	Age
House price	Distance from city centre
Urban crime	Police visibility

1.2 Suppose you want to conduct an hypothesis test for the slope, β, from the regression in which the dependent variable is Urban crime and the explanatory variable is Policy visibility. Formulate the null and alternative hypotheses for a two-sided hypothesis test. [4]

1.3 Now do the same, but supposing a one-sided hypothesis test. [4]

1.4 Assume $\hat{\beta}$ represents the estimated slope coefficient. Explain what is meant by its Standard Error. [4]

1.5 Using examples and appropriate notation, explain the difference between a regression model using cross-sectional data versus one using time series data. [6]

1.6 Explain the role of the Central Limit Theorem in statistical inference. [6]

QUESTION 2 [24]

Consider the set of results below, where the "lN_" preceding a variable indicates a natural logarithm. (In other words, the variable "lN_Wages" is the natural logarithm of the "Wages" variable.)

```
Dependent Variable: LN_WAGE
Method: Least Squares
Date: 04/22/25   Time: 14:45
Sample: 1 500
Included observations: 500

Variable        Coefficient    Std. Error    t-Statistic    Prob.
-------------------------------------------------------------------
C                1.205132      0.425612       2.83         0.0048
LN_EDUCATION     0.454291      0.072133       6.30         0.0000
LN_EXPERIENCE    0.195874      0.059985       3.27         0.0011
LN_HOURS         0.362221      0.087994       4.11         0.0000
LN_AGE          -0.126732      0.099713      -1.27         0.2038

R-squared          0.2694
Adjusted R-squared 0.2627
S.E. of regression 0.6898
F-statistic        45.89
Prob(F-statistic)  0.000000
```

2.1 What is the name of this functional form, and why is it sometimes preferred over the linear functional form? [5]

2.2 State and interpret R-squared. [5]

2.3 Interpret fully the estimated slope coefficient on the LN_EDUCATION variable. [5]

2.4 Conduct a hypothesis test at the 5% significance level whereby the null hypothesis is that the true slope on the LN_EXPERIENCE variable is equal to 0. [5]

2.5 Consider the 'F-test for the regression', recalling that this is the test for which the null hypothesis is that all of the slopes are equal to zero. Can you or can you not reject this null at the 1% significance level? Justify your answer. [4]

QUESTION 3 [20]

Define the following concepts as they relate to econometrics:

3.1 Type II error [4]

3.2 Specification error [4]

3.3 Confidence interval [4]

3.4 Joint hypothesis test [4]

3.5 Multicollinearity [4]

QUESTION 4 [24]

You have annual time series data with which to explore what influences the size of Egypt's economy. Your model is as follows:

$$GDP_t = \beta_0 + \beta_1 \cdot GFCF_t + \beta_2 \cdot GOVTEXP_t + \varepsilon_t$$

where:

- GDP_t is gross domestic product in year t in billions of 2015 constant (i.e. inflation-adjusted) Egyptian Pounds.
- $GFCF_t$ is gross fixed capital formation in year t in billions of 2015 constant Egyptian Pounds; gross fixed capital formation refers to the amount of money used in a period to create or purchase productive assets such as factory buildings and machines.
- $GOVTEXP_t$ is the general government final consumption expenditure in year t in billions of 2015 constant Egyptian Pounds; this includes all government current expenditures for purchases of goods and services, including compensation of employees.

Your results are below:

```
Model 1: OLS, using observations 1982-2023 (T = 42)
Dependent variable: GDP

             coefficient   std. error   t-ratio    p-value
  ---------------------------------------------------------
  const      -401.249      76.5163      -5.244     5.78e-06  ***
  GFCF          0.827620    0.272093     3.042     0.0042    ***
  GOVTEXP      12.8154      0.593515    21.59      2.68e-023 ***

Mean dependent var   3849.256   S.D. dependent var   1996.462
Sum squared resid     1684832   S.E. of regression   207.8481
R-squared            0.989690   Adjusted R-squared   0.989161
F(2, 39)             1871.903   P-value(F)           1.81e-39
Log-likelihood      -282.1851   Akaike criterion     570.3701
Schwarz criterion    575.5831   Hannan-Quinn         572.2809
rho                  0.847772   Durbin-Watson        0.474862
```

4.1 What do the results suggest about the economic efficacy of the Egyptian government's consumption expenditure? [4]

You are aware that from 1981 until the 2011 Egyptian Revolution, Egypt was led by President Hosni Mubarak, whose rule was regarded as somewhat oppressive, but stable. Since the Revolution, Egypt has experienced a great deal of political turbulence. You introduce a dummy variable, called "REGIME", in order to see if you can capture the influence of the regime change in Egypt; this variable has a value of 0 up to 2011, and 1 thereafter. Below are the results of the regression:

```
Model 3: OLS, using observations 1982-2023 (T = 42)
Dependent variable: GDP

             coefficient   std. error   t-ratio    p-value
  ---------------------------------------------------------
  const      -292.545      103.504      -2.826     0.0075    ***
  GFCF          0.957630    0.280722     3.411     0.0015    ***
  GOVTEXP      11.9759      0.801183    14.95      1.69e-017 ***
  REGIME      206.698     135.161        1.529     0.1345

Mean dependent var   3849.256   S.D. dependent var   1996.462
Sum squared resid     1587152   S.E. of regression   204.3702
R-squared            0.990288   Adjusted R-squared   0.989521
F(3, 38)             1291.551   P-value(F)           2.87e-38
Log-likelihood      -280.9308   Akaike criterion     569.8617
Schwarz criterion    576.8124   Hannan-Quinn         572.4094
rho                  0.852630   Durbin-Watson        0.502895
```

4.2 What can you conclude regarding the influence of Egypt's regime change on its economy? [4]

4.3 Name one other variable you would like to include as an explanatory variable in order to possibly better understand what influences GDP in Egypt, and state your *a priori* expectation regarding the relationship of GDP to your proposed additional explanatory variable. [5]

Suppose you save the residuals from this regression, which we will call "resid". You then run the following regression, where "resid_1" represents the one-period lag of "resid":

```
Model 4: OLS, using observations 1983-2023 (T = 41)
Dependent variable: resid

             coefficient   std. error   t-ratio   p-value
  ---------------------------------------------------------
  resid_1     0.852630      0.132201     6.450    1.10e-07 ***

Mean dependent var  -2.183837   S.D. dependent var   198.6794
Sum squared resid    774122.3   S.E. of regression   139.1153
Uncentered R-squared 0.509781   Centered R-squared   0.509720
F(1, 40)             41.59616   P-value(F)           1.10e-07
Log-likelihood      -260.0177   Akaike criterion     522.0354
Schwarz criterion    523.7490   Hannan-Quinn         522.6594
rho                  0.452655   Durbin's h           5.444119
```

4.4 Unfortunately, these results suggest that your model is afflicted by a problem. What is the name of that problem, and what are its consequences? [5]

4.5 Name the technique that you might use to address this problem, and explain what it involves. [6]