UNIVERSITY OF FORT HARE
DEPARTMENT OF ECONOMICS

ALICE, BHISHO AND EAST LONDON CAMPUSES

ECO 313/313E

FINAL EXAMINATION

2023

Subject: ECONOMETRICS 3 **Marks: 100**
Time: 3 Hours

This paper consists of 6 pages including the cover page

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Instructions

Answer FOUR (4) questions ONLY.
All questions carry EQUAL marks.

QUESTION 1 [25 MARKS]

1.1 Giving example(s), differentiate between simple linear regression and multiple linear regression? ***[4 marks]***

1.2 What is an error term and why is it included in a regression model? ***[6 marks]***

1.3 The table below shows the OLS results on the impact of real interest rate (**r**) on gross domestic product **(gdp)** in South Africa for the period spanning 1994 to 2021.

Interpret the results given in the table below. *[15 marks]*

OLS Regression Results

Dep. Variable:	gdp	R-squared (uncentered):	0.451
Model:	OLS	Adj. R-squared (uncentered):	0.431
Method:	Least Squares	F-statistic:	22.20
Date:	Wed, 22 Mar 2023	Prob (F-statistic):	6.60e-05
Time:	22:54:21	Log-Likelihood:	-65.574
No. Observations:	28	AIC:	133.1
Df Residuals:	27	BIC:	134.5
Df Model:	1		
Covariance Type:	nonrobust		

	coef	std err	t	P>|t|	[0.025	0.975]
r	0.3792	0.080	4.712	0.000	0.214	0.544

Omnibus:	7.143	Durbin-Watson:	1.497
Prob(Omnibus):	0.028	Jarque-Bera (JB):	5.280
Skew:	-0.869	Prob(JB):	0.0713
Kurtosis:	4.227	Cond. No.	1.00

NB: Prob(F-statistics) value of 6.60e-05 is the same as 0.0000660

QUESTION 2 [25 MARKS]

2.1 What is heteroscedasticity and why is it a problem in regression analysis? ***[4 marks]***

2.2 List **any four** different functional forms of regression models. ***[4 marks]***

2.3 Explain what is meant by 'specification error', and name the 3 main types of specification error. ***[7 marks]***

2.4 State and explain the type of data to be employed in the following scenarios. ***[10 marks]***

2.4.1 The 2011 South African population census conducted by Statistics South Africa.

2.4.2 Annual savings for one million randomly chosen South African households for the year 2021

2.4.3 Weekly Johannesburg Stock Exchange All Share price index

2.4.4 Unemployment rates for each South African province since 1994

2.4.5 Daily ZAR/USA exchange rate

QUESTION 3 **[25 MARKS]**

3.1 What is the difference between a t-test and an F-test in regression analysis? ***[4 marks]***

3.2 What are Dummy Variables and why are they used in regression analysis? ***[6 marks]***

3.3 What are the consequences of imperfect ('near') multicollinearity? ***[5 marks]***

3.4 Write out a sample regression model based on cross-sectional data consisting of a sample size of 752 and involving three explanatory variables. Now explain or identify each and every term in the model. ***[10 marks]***

QUESTION 4 **[25 MARKS]**

4.1 What is the difference between a Type I error and a Type II error in hypothesis testing? ***[4 marks]***

4.2 Suppose you regress Y on X, and your t-ratio associated with the your X variable is such that you cannot reject the null hypothesis of no relationship between Y and X at the 5% significance level. Do you have proof that Y and X are unrelated? Justify your answer. *[3 marks]*

4.3 Define multicollinearity and give 2 ways in which it can be remedied ***[6 marks]***

4.4 Suppose the South African Reserve Bank (the SARB) is seeking to investigate the impact of inflation on economic growth in South Africa from 1994 to 2022.

4.4.1 As the SARB economic adviser, what type of data would you need to carry out this assignment. Justify. ***[2 marks]***

4.4.2 Set up an econometric model to investigate the impact of inflation on economic growth in South Africa from 1994 to 2020. In order to do so, identify your variables and specify your model. ***[10 marks]***

QUESTION 5 **[25 MARKS]**

5.1 Explain why most regression models have a constant term. ***[4 marks]***

5.2 Write out a population regression model based on cross-sectional data from population of size N and involving three explanatory/independent variables. Now explain or identify each and every term in the model. ***[7 marks]***

5.3 Suppose that one of your three explanatory variables in Question 5.2 is a dummy variable. Explain what a dummy variable is, what values it may take, and why you would use one in a regression model. ***[4 marks]***

5.4 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. ***[10 marks]***

Dependent Variable	**Explanatory**
Personal savings	Rate of interest
Price of maize meal	Demand for rice
Student's mark on Test 2	Student's mark on Test 1
Demand for cigarettes	Tax rate on cigarettes
Wages	Age

QUESTION 6 **[25 MARKS]**

You have time series data regarding aggregate consumption of textiles from data from 1993 through 2009. The three variables for which you have data are as follows:

Consume = volume of textile consumption per capita

Income = inflation-adjusted income per capita

Price = inflation-adjusted price of textiles

You take the natural logarithm of each variable, and your new corresponding variables are called l_consume, l_income and l_price. You then run a regression model in which l_consume is a function of l_income and l_price. The results are as follows:

OLS, using observations 1993-2009 (T = 17)

Dependent variable: l_consume

	Coefficient	Std. Error	t-ratio	p-value	
Const	3.16355	0.704799	4.489	0.0005	***
l_income	1.14316	0.156000	7.328	<0.0001	***
l_price	−0.828837	0.0361114	−22.95	<0.0001	***

Mean dependent var	4.886397	S.D. dependent var	0.182165
Sum squared resid	0.013613	S.E. of regression	0.031183
R-squared	0.974361	Adjusted R-squared	0.970698
F(2, 14)	266.0179	P-value(F)	7.28e-12
Log-likelihood	36.48253	Akaike criterion	−66.96506
Schwarz criterion	−64.46542	Hannan-Quinn	−66.71660
rho	0.113852	Durbin-Watson	0.926685

6.1 Interpret in words the estimated slope coefficients on the l_income and l_price variables. ***[6 marks]***

6.2 Interpret in words the meaning of the R-squared and the Adjusted R-squared. ***[6 marks]***

6.3 Explain what serial correlation is (also known as auto-correlation), and in what way it is a problem when using Ordinary Least Squares. ***[5 marks]***

6.4 Using the results presented and the resources below, determine whether or not you have a serial correlation problem and explain how you know. ***[8 marks]***

DURBIN-WATSON d TEST: DECISION RULES

Null hypothesis	Decision	If
No positive autocorrelation	Reject	$0 < d < d_L$
No positive autocorrelation	No decision	$d_L \leq d \leq d_U$
No negative autocorrelation	Reject	$4 - d_L < d < 4$
No negative autocorrelation	No decision	$4 - d_U \leq d \leq 4 - d_L$
No positive or negative autocorrelation	Do not reject	$d_U < d < 4 - d_U$

	$K=1$		$K=2$		$K=3$	
n	d_L	d_U	d_L	d_U	d_L	d_U
6	0.610	1.400	—	—	—	—
7	0.700	1.356	0.467	1.896	—	—
8	0.763	1.332	0.559	1.777	0.368	2.287
9	0.824	1.320	0.629	1.699	0.455	2.128
10	0.879	1.320	0.697	1.641	0.525	2.016
11	0.927	1.324	0.658	1.604	0.595	1.928
12	0.971	1.331	0.812	1.579	0.658	1.864
13	1.010	1.340	0.861	1.562	0.715	1.816
14	1.045	1.350	0.905	1.551	0.767	1.779
15	1.077	1.361	0.946	1.543	0.814	1.750
16	1.106	1.371	0.982	1.539	0.857	1.728
17	1.133	1.381	1.015	1.536	0.897	1.710
18	1.158	1.391	1.046	1.535	0.933	1.696
19	1.180	1.401	1.074	1.536	0.967	1.685
20	1.201	1.411	1.100	1.537	0.998	1.676

END