NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY

FACULTY OF COMMERCE, HUMAN SCIENCES AND EDUCATION

DEPARTMENT OF ACCOUNTING, ECONOMICS AND FINANCE

QUALIFICATION: BACHELOR OF ECONOMICS HONOURS DEGREE	
QUALIFICATION CODE: 08HECO	**LEVEL:** 8
COURSE CODE: AEM810S	**COURSE NAME:** APPLIED ECONOMETRICS
SESSION:	**PAPER:** THEORY
DURATION: 3 HOURS	**MARKS:** 100

SECOND OPPORTUNITY QUESTION PAPER	
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MODERATOR:	Dr. Reinhold Kamati

INSTRUCTIONS

1. Answer all questions.
2. Write clearly and neatly.
3. Number the answers.

PERMISSIBLE MATERIALS

1. Ruler
2. calculator

THIS QUESTION PAPER CONSISTS OF 6 PAGES

QUESTION 1 [25 marks]

a) State the formulae used to test for unit roots using the Dickey Fuller test and the Augmented Dickey Fuller test. [12]

b) What is the difference between the two tests? [2]

c) State the hypotheses and the decision rules for the tests in (a).[3]

d) What orders of integration are appropriate when using the methods in Table 1? [8]

Table 1

Methodology	Appropriate order of integration
i. OLS	
ii. ECM	
ii. ARDL	
iv. ARDL-ECM	
v. VAR	
vi. VECM	

QUESTION 2 [25 marks]

Explain all steps you would take to apply the cointegration and error correction modelling (ECM) technique. Assume that the dependent variable is Gross Domestic Product (Y), and the independent variables are Capital (K) and Labour (L).

a) What order of integration of the variables is appropriate to run this model? [2]

b) Specify the long-run equation with an intercept and no trend. [5]

c) Explain how you generate the errors and use them to test for cointegration (state the hypothesis and decision rule for the cointegration test). [6]

d) If there is no cointegration, what do you do? [2]

e) If there is cointegration among the variables, state the model you estimate. [5]

f) Which parameters in your model are short-run and which parameters are long-run? [5]

QUESTION 3 [25 marks]

(a) Suppose you want to test for the Dynamic Granger causality between GDP (Y) and money supply (M), whose model is given as follows:

$$\Delta Y_t = \lambda_0 + \sum_{i=1}^{n} \lambda_{1i}\Delta Y_{t-i} + \sum_{i=1}^{n} \lambda_{2i}\Delta M_{t-1} + \lambda_3\epsilon_{1t-1} + \mu_{1t} \qquad (1)$$

$$\Delta M_t = \varphi_0 + \sum_{i=1}^{n} \varphi_{1i}\Delta Y_{t-i} + \sum_{i=1}^{n} \varphi_{2i}\Delta M_{t-1} + \varphi_3\epsilon_{2t-1} + \mu_{2t} \qquad (2)$$

a) State the hypothesis and decision rule used when testing whether money supply Granger causes GDP. [5]
b) State the hypothesis and decision rule used when testing whether GDP Granger causes Money Supply. [5]
c) State the joint Granger causality hypotheses for the two equations. [5]
d) State the conditions that must be met in this VAR model to have feedback causality. [5]
e) State the conditions that must be met in this VAR model to have unidirectional causality running from M to Y. [5]

QUESTION 4 [25 marks]

Use the estimated model below in Table 1 to answer the following questions:

a) State the econometrics method used to obtain these results? [1]
b) What is the order of integration of the variables used in the model? [1]
c) Is the estimated model over-parameterized or parsimonious? [1]
d) Interpret the DW statistic in each of the estimated models? [3]
e) Comment on all the possible Granger causality relationships you observe in the results. [7]

Table 1
System: UNTITLED
Estimation Method: Least Squares
Date: 06/03/21 Time: 15:55
Sample: 1993 2019
Included observations: 27

Total system (balanced) observations 81				
	Coefficient	Std. Error	t-Statistic	Prob.
C(2)	-0.847813	0.299441	-2.831313	0.0061
C(3)	0.610685	0.192159	3.178019	0.0022
C(6)	0.132214	0.065553	2.016896	0.0476
C(7)	0.030303	0.008845	3.425799	0.0010
C(9)	-1.006227	0.217585	-4.624524	0.0000
C(10)	0.480942	0.139630	3.444412	0.0010
C(13)	0.171119	0.047633	3.592429	0.0006
C(14)	0.039613	0.006427	6.163073	0.0000
C(16)	-3.543975	1.070876	-3.309417	0.0015
C(17)	4.801334	0.906802	5.294798	0.0000
C(19)	-0.474299	0.186298	-2.545917	0.0131
C(20)	0.350457	0.256055	1.368676	0.1755
Determinant residual covariance		2.65E-11		
Equation: D(LNGDP) = C(2)*D(LNGDP(-2)) + C(3)*D(LNPCE(-1)) + C(6) *D(LNPDI(-2)) + C(7)				
Observations: 27				
R-squared	0.404463	Mean dependent var		0.029535
Adjusted R-squared	0.326784	S.D. dependent var		0.021068
S.E. of regression	0.017286	Sum squared resid		0.006873
Durbin-Watson stat	2.431954			
Equation: D(LNPCE) = C(9)*D(LNGDP(-2)) + C(10)*D(LNPCE(-1)) + C(13)*D(LNPDI(-2)) + C(14)				
Observations: 27				
R-squared	0.553562	Mean dependent var		0.031553
Adjusted R-squared	0.495331	S.D. dependent var		0.017681
S.E. of regression	0.012561	Sum squared resid		0.003629
Durbin-Watson stat	2.008833			
Equation: D(LNPDI) = C(16)*D(LNGDP(-2)) + C(17)*D(LNPCE(-1)) + C(19)*D(LNPDI(-1)) + C(20)*D(LNPDI(-2))				
Observations: 27				
R-squared	0.512427	Mean dependent var		0.041603
Adjusted R-squared	0.448831	S.D. dependent var		0.102684
S.E. of regression	0.076234	Sum squared resid		0.133666
Durbin-Watson stat	2.332224			

f) Explain how you get the lag length from these results. [6]

Table 2: VAR Lag Order Selection Criteria
Endogenous variables: D(LNGDP) D(LNPCE) D(LNPDI)
Exogenous variables: C
Date: 06/03/21 Time: 16:36
Sample: 1990 2019
Included observations: 27

Lag	LogL	LR	FPE	AIC	SC	HQ
0	201.9214	NA	8.00e-11	-14.73492	-14.59094*	-14.69211
1	207.0165	8.680476	0.108	-14.44566	-13.86974	-14.27441
2	229.7969	33.74871*	0.00399	-15.46643*	-14.45856	-15.16674*

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

g) Interpret the cointegrating results below. [6]

Table 3: Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.873210	61.18868	29.79707	0.0000
At most 1	0.147946	5.427621	15.49471	0.7619
At most 2	0.040092	1.104782	3.841465	0.2932

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
* Denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.873210	55.76106	21.13162	0.0000
At most 1	0.147946	4.322839	14.26460	0.8238
At most 2	0.040092	1.104782	3.841465	0.2932

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* Denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values