NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY

FACULTY OF HEALTH, NATURAL RESOURCES AND APPLIED SCIENCES
SCHOOL OF AGRICULTURE AND NATURAL RESOURCES SCIENCES
DEPARTMENT OF AGRICULTURAL SCIENCES AND AGRIBUSINESS

QUALIFICATION: BACHELOR OF SCIENCE IN AGRICULTURE (AGRIBUSINESS MANAGEMENT)	
QUALIFICATION CODE: 07BAGA	**LEVEL:** 7
COURSE CODE: BEA621S	**COURSE NAME:** BASIC ECONOMETRICS FOR AGRICULTURE
DATE: NOVEMBER 2024	**PAPER 1**
DURATION: 3 HOURS	**MARKS: 100**

FIRST OPPORTUNITY EXAMINATION QUESTION PAPER	
EXAMINER(S)	Prof David Uchezuba
MODERATOR:	Mr Mwala Lubinda

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

PERMISSIBLE MATERIALS

1. Examination question paper
2. Answering book

THIS QUESTION PAPER CONSISTS OF 12 PAGES (Excluding this front page)

SECTION 1 MULTIPLE CHOICE QUESTIONS (20 MARKS)

Question 1

Assume the consumption function Namibia is represented by the equation Y = 0.1521 + 0.4578X +U. The marginal propensity to consume is.

A) 0.3057

B) 0.4578

C) 0.1521

D) 0.6099

Question 2

A model to determine the relationship between yield and fertiliser application is given as Y = 0.2142 + 0.8124X. Which of the following statements about the model is **correct?**

A) It is deterministic

B) It is stochastic

C) It is non-stationary

D) It gives an accurate prediction of yield.

Question 3

Which of the following statements is not correct about this function, $y = \beta_1 + \beta_2 x + u$.

A) It is a probabilistic function

B) It is a random function

C) It is a stochastic function

D) It is a determinist function.

Question 4

The measure of the strength of the degree of association between two variables is called

A) Dispersion

B) Dependence

C) Correlation

D) Causation

Question 5

Survey data about food security status collected quarterly for two years is an example of

A) Panel data

B) Time series data

C) Cross-sectional data

D) Longitudinal data

Question 6

A survey of rural poverty classified respondents as, very poor, poor, and rich. What type of measurement scale was used to collect this data?

A) Nominal scale

B) Interval scale

C) Ordinal scale

D) Ratio scale

Question 7

The locus of the conditional means of the dependent variable for the fixed values of the explanatory variable(s) is known as.

A) Sample expectation

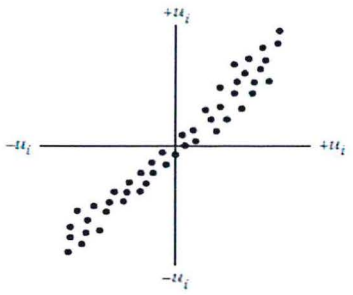
B) Population expectation

C) Unconditional expectation

D) Conditional expectation

Question 8

The chart below shows the pattern of a post-regression residual.



Which of the following statements is correct?

A) There is a positive serial correlation in the residual

B) There is a negative serial correlation in the residual

C) There is a zero correlation in the residual

D) There is both positive and negative serial correlation in the residual.

Question 9

In a simple linear regression model y = $\beta_1 + \beta_2 x + u$, the slope coefficient measures.

A) The elasticity of y with respect to x

B) The change in y which the model predicts for a unit change in x.

C) The change in x which the model predicts for a unit change in y

D) The ratio of y to x

E) The value of y for any given value of x

Question 10

The equation, $y = \beta_1 + \beta_2 x + u$, has two components depicting the type of relation between the dependent variable and the independent variables. These are the deterministic (systematic) relationship and the stochastic (random) relationship. A deterministic relationship is a relationship in which.

A) The value of a dependent variable is completely determined by the values of the observable independent variable(s).

B) The value of the dependent variable is completely predictable based on the values of the observable independent variables.

C) There is no room for randomness or uncertainty.

D) None of the above

Question 11

We fit a regression model to a data serial to determine model adequacy. This means we determine,

A) The goodness of fit of the regressand to the model

B) The goodness of fit of the regressors to the model

C) The goodness of fit of the data to model

D) The goodness of fit of the model to the data

Question 12

Identify incorrect answers. An estimator may not satisfy one or more desirable statistical properties in small samples. However as the sample size increases indefinitely, the estimators possess several desirable statistical properties. These properties are known as

A) Large sample properties

B) Small sample properties

C) Asymptotic efficiency

D) Asymptotic consistency

Question 13

Which of the following incorrectly defines a normal distribution?

A) It has zero mean

B) It has a constant variance

C) It has zero covariance

D) It has zero kurtosis

Question 14

Which of the following cannot result in a specification bias

A) Omitted variable

B) Measurement error

C) Data mining

D) wrong functional form

Question 15

The conditional expectation function $E(y|x_i) = \beta_1 + \beta_2 x_i + \mu_1$, states that

A) The expected value of the distribution of y given x_i is functionally unrelated to x_i

B) The expected value of the distribution of y given x_i is functionally related to x_i

C) The expected value of the distribution of x given x_i is functionally related to y_i

D) The mean or average response of y is a multiplicative function of x

E) The mean or average response of y is independent of x

Question 16

If the relationship between corn yield and fertiliser input used is represented by the equation, $E(y|x) = \beta_1 + \beta_2 x$. Which of the following statements is incorrect?

A) The $E(y|x)$ is a linear function of x

B) The average value of corn yield changes with the level of fertiliser applied.

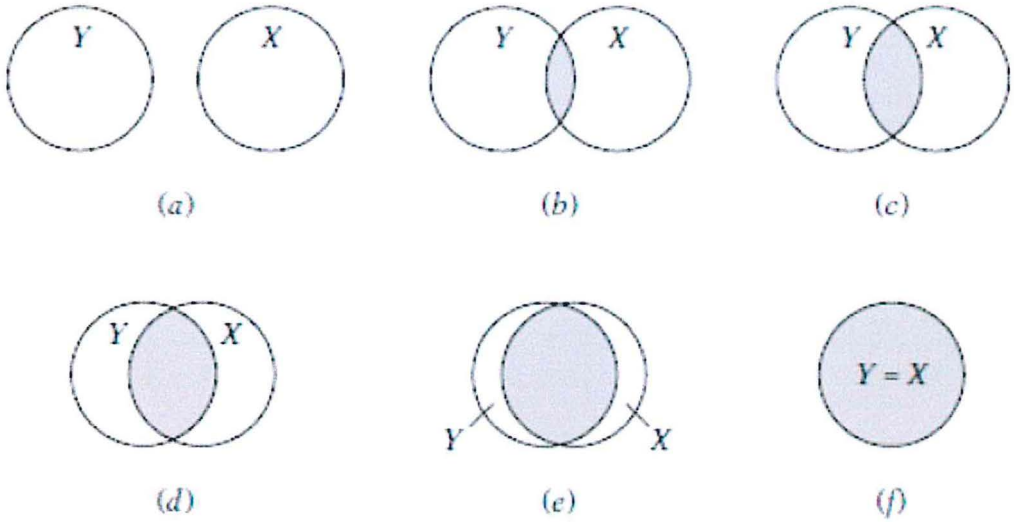
C) For any given value of fertiliser applied, the distribution of corn yield is centred around. $E(y|x)$

D) One unit change increase in fertiliser applied changes the expected value of corn yield by the amount of β_1

E) Corn yield equals = $\beta_1 + \beta_2 x$, for all units in the population.

Question 17

The relationship between Y and X is shown in a Venn diagram. Which of the diagrams has $R^2 = 1$?



A) (b)

B) (f)

C) (e)

D) (a)

Question 18

In the language of significance tests, a statistic is said to be statistically significant if

A) The value of the test statistic lies in the critical region.

B) The value of the test statistic lies outside the critical region.

C) The value of the test statistic is less than the critical value

D) The value of the critical value is greater than the test statistic

Question 19

The lowest significance level at which a null hypothesis can be rejected is known as the

A) T-test
B) Probability value
C) Type I error
D) BLUE

Question 20

An estimator produces an estimate. What is an estimate? Which option is incorrect?

A) An estimate is a value or a range of values that is used to approximate a quantity that is not known with certainty.

B) An estimate is a value or a range of values that is used to approximate a quantity that is known with certainty.

C) The accuracy of the estimate depends on the size of the sample, the variability of the data, and the quality of the estimator.

D) An estimate is usually based on incomplete or partial information and is therefore subject to uncertainty.

E) An estimate is often used to approximate a population parameter, such as the mean or the variance, based on a sample of data.

SECTION 2 ESSAY-TYPES QUESTIONS (80 MARKS)

Question 1 (20 Marks)

1.1. The average sales and advertising expenditure in thirteen departmental stores was analysed assuming that sales is a function of advertising using the model,

$y = \beta_1 + \beta_2 x + u$.

Where y = sales, x = advertising and u = error term. The sum of the squares of the analysis is given as follows.

$$\sum_{i=1}^{n} y = 147.10, \quad \sum_{i=1}^{n} x = 141.18, \quad \sum_{i=1}^{n} y_i x_i = 0.2828, \quad \sum_{i=1}^{n} x^2 = 0.2960, \quad \sum_{i=1}^{n} \hat{u}^2 = 0.0040,$$

$$\sum_{i=1}^{n} (y - \bar{y})^2 = 0.2741$$

Calculate the value of the following

1.1.1 The slope parameter (2 Marks)

1.1.2. The intercept parameter (2 Marks)

1.1.3. The variance of the regression (2 Marks)

1.1.4. The variance of slope parameter (2 Marks)

1.1.5. The explained sum of squares (2 Marks)

1.1.6. The total sum of squares (2 Marks)

1.1.7. The coefficient of determination (2 Marks)

1.2 . Fit the equation of the regression line (2 Marks)

1.3. Predict the mean inventory value $\hat{y}$ for x = 10.90 (2 Marks)

1.4. Interpret the value of the slope parameter (2 Mrks)

Question 2 (20 Marks)

2.1. Tables 1 and 2 are the post-regression results showing the relationship between average consumption expenditure and disposable income of selected households in the US (Measured in million $). Answer the questions below.

Table 1

Variables	Coefficients	Standard Error	t Stat	P-value
Intercept	24.4546	6.4138	( )	0.0051
Income	0.5091	0.0357	14.2432	0.0000
R^2	0.9808			
Observation	10			
Durbin Watson	2.680			

Table 2

ANOVA TABLE					
	df	SS	MS	F	Significance F
ESS	1	8552.73	( )	( )	0.0000
RSS	8	( )	42.16		
TSS	( )	8890.00			

Note: ESS = Explained sum of squares, RSS = Residual Sum of Squares, TSS = Total sum of squares.

2.1.1 Calculate the missing values (5 Marks)

2.1.2. Interpret the value of the slope coefficient (2 Marks)

2.1.3 Interpret the value of R^2 (2 Marks)

2.1.4. Fit the equation of the regression line (1 Mark)

2.2.3. At 95 % confidence level shows that the slope coefficient is statistically different from zero. (5 Marks)

2.2.4. Test that the residual of the regression does not have first-order autocorrelation. (5 Marks)

Question 3 (20 Marks)

3.1. What is the meaning of the following econometrics terminologies?

3.1.1	Parameter estimate	(2 Marks)
3.1.2	Stochastic variable	(2 Marks)
3.1.3.	Non-stationay variable	(2 Marks)
3.1.4.	Probability distribution of a variable	(2 Marks)
3.1.5.	Analysis of variance	(2 Marks)
3.1.6.	Null hypothesis	(2 Marks)
3.1.7.	Type II error	(2 Marks)
3.1.8.	Heteroscedasticity	(2 Marks)
3.1.9.	Normal distribution	(2 Marks)
3.1.10	Residual	(2 Marks)

Question 4 (20 Marks)

4.1. What are the consequences of the following violation of a classical linear regression model?

4.1.1	Non-linearity in regression parameter	(2 Marks)
4.1.2	Stochastic regressors in a regression model	(2 marks)
4.1.3.	Non-zero mean of the disturbance term	(2 marks)
4.1.4.	Heteroscedasticity in the model	(2 marks)
4.1.5.	Auto-correlated disturbances	(2 marks)
4.1.6.	Sample observation is less than the number of regressors	(2 marks)
4.1.7.	Insufficient variability in regressors	(2 marks)
4.1.8.	Multicollinearity	(2 marks)
4.1.9.	Specification bias	(2 marks)
4.1.10.	Non-normality of disturbances	(2 marks)

END

Formulas and statistical tables

$$\hat{\beta}_2 = \frac{\sum_{i=1}^{N} x_i y_i}{\sum_{i=1}^{N} x_i^2} \qquad \hat{\beta}_1 = \bar{Y} - \hat{\beta}_2 \bar{X} \qquad \hat{\sigma}^2 = \frac{\sum_{i=1}^{N} \hat{u}_i^2}{N-2} \qquad Var(\hat{\beta}_2) = \frac{\sigma^2}{\sum_{i=1}^{N} x_i^2}$$

$$R^2 = 1 - \frac{\sum_{i=1}^{N} \hat{u}_i^2}{\sum_{i=1}^{N} (Y_i - \bar{Y})^2}, \text{ or} \qquad R^2 = \hat{\beta}_2^2 \left(\frac{\sum_{i=1}^{N} x_i^2}{\sum_{i=1}^{N} y_i^2}\right), \text{ or} \qquad R^2 = \left(\frac{(\sum_{i=1}^{N} x_i y_i)^2}{\sum_{i=1}^{N} x_i^2 \sum_{i=1}^{N} y_i^2}\right)$$

$$R^2 = \left(\frac{(\sum_{i=1}^{N} x_i y_i)^2}{\sum_{i=1}^{N} x_i^2 \sum_{i=1}^{N} y_i^2}\right) \qquad se(\hat{\beta}_2) = \frac{\sigma}{\sqrt{\sum_{i=1}^{N} x_i^2}} = \frac{\sqrt{\text{var}(\hat{\beta}_2)}}{\sqrt{\sum_{i=1}^{N} x_i^2}} \qquad t = \frac{\hat{\beta}_2 - \beta_2}{se(\beta_2)}$$

$$JB = n\left[\frac{S^2}{6} + \frac{(K-3)^2}{24}\right] \qquad \hat{\beta}_2 = \frac{\sum_{i=1}^{N} (x_i y_i)^2}{\sum_{i=1}^{N} x_i^2} \qquad \hat{\beta}_1 = \bar{Y} - \hat{\beta}_2 X \qquad ESS = \hat{\beta}_2^2 \sum_i x_i^2$$

T-distribution table

df \ Pr	0.25 0.50	0.10 0.20	0.05 0.10	0.025 0.05	0.01 0.02	0.005 0.010	0.001 0.002
1	1.000	3.078	6.314	12.706	31.821	63.657	318.31
2	0.816	1.886	2.920	4.303	6.965	9.925	22.327
3	0.765	1.638	2.353	3.182	4.541	5.841	10.214
4	0.741	1.533	2.132	2.776	3.747	4.604	7.173
5	0.727	1.476	2.015	2.571	3.365	4.032	5.893
6	0.718	1.440	1.943	2.447	3.143	3.707	5.208
7	0.711	1.415	1.895	2.365	2.998	3.499	4.785
8	0.706	1.397	1.860	2.306	2.896	3.355	4.501
9	0.703	1.383	1.833	2.262	2.821	3.250	4.297
10	0.700	1.372	1.812	2.228	2.764	3.169	4.144
11	0.697	1.363	1.796	2.201	2.718	3.106	4.025
12	0.695	1.356	1.782	2.179	2.681	3.055	3.930
13	0.694	1.350	1.771	2.160	2.650	3.012	3.852
14	0.692	1.345	1.761	2.145	2.624	2.977	3.787
15	0.691	1.341	1.753	2.131	2.602	2.947	3.733
16	0.690	1.337	1.746	2.120	2.583	2.921	3.686
17	0.689	1.333	1.740	2.110	2.567	2.898	3.646
18	0.688	1.330	1.734	2.101	2.552	2.878	3.610
19	0.688	1.328	1.729	2.093	2.539	2.861	3.579
20	0.687	1.325	1.725	2.086	2.528	2.845	3.552
21	0.686	1.323	1.721	2.080	2.518	2.831	3.527
22	0.686	1.321	1.717	2.074	2.508	2.819	3.505
23	0.685	1.319	1.714	2.069	2.500	2.807	3.485
24	0.685	1.318	1.711	2.064	2.492	2.797	3.467
25	0.684	1.316	1.708	2.060	2.485	2.787	3.450
26	0.684	1.315	1.706	2.056	2.479	2.779	3.435
27	0.684	1.314	1.703	2.052	2.473	2.771	3.421
28	0.683	1.313	1.701	2.048	2.467	2.763	3.408
29	0.683	1.311	1.699	2.045	2.462	2.756	3.396
30	0.683	1.310	1.697	2.042	2.457	2.750	3.385
40	0.681	1.303	1.684	2.021	2.423	2.704	3.307
60	0.679	1.296	1.671	2.000	2.390	2.660	3.232
120	0.677	1.289	1.658	1.980	2.358	2.617	3.160
∞	0.674	1.282	1.645	1.960	2.326	2.576	3.090

DURBIN–WATSON d STATISTIC: SIGNIFICANCE POINTS OF d_L AND d_U AT 0.05 LEVEL OF SIGNIFICANCE

	$k' = 1$		$k' = 2$		$k' = 3$		$k' = 4$		$k' = 5$		$k' = 6$		$k' = 7$		$k' = 8$		$k' = 9$		$k' = 10$	
n	d_L	d_U	d_L	d_U	d_L	d_U	d_L	d_U	d_L	d_U	d_L	d_U	d_L	d_U	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	0.296	2.588	—	—	—	—	—	—	—	—	—	—	—	—
10	0.879	1.320	0.697	1.641	0.525	2.016	0.376	2.414	0.243	2.822	—	—	—	—	—	—	—	—	—	—
11	0.927	1.324	0.658	1.604	0.595	1.928	0.444	2.283	0.316	2.645	0.203	3.005	—	—	—	—	—	—	—	—
12	0.971	1.331	0.812	1.579	0.658	1.864	0.512	2.177	0.379	2.506	0.268	2.832	0.171	3.149	—	—	—	—	—	—
13	1.010	1.340	0.861	1.562	0.715	1.816	0.574	2.094	0.445	2.390	0.328	2.692	0.230	2.985	0.147	3.266	—	—	—	—
14	1.045	1.350	0.905	1.551	0.767	1.779	0.632	2.030	0.505	2.296	0.389	2.572	0.286	2.848	0.200	3.111	0.127	3.360	—	—
15	1.077	1.361	0.946	1.543	0.814	1.750	0.685	1.977	0.562	2.220	0.447	2.472	0.343	2.727	0.251	2.979	0.175	3.216	0.111	3.438
16	1.106	1.371	0.982	1.539	0.857	1.728	0.734	1.935	0.615	2.157	0.502	2.388	0.398	2.624	0.304	2.860	0.222	3.090	0.155	3.304
17	1.133	1.381	1.015	1.536	0.897	1.710	0.779	1.900	0.664	2.104	0.554	2.318	0.451	2.537	0.356	2.757	0.272	2.975	0.198	3.184
18	1.158	1.391	1.046	1.535	0.933	1.696	0.820	1.872	0.710	2.060	0.603	2.257	0.502	2.461	0.407	2.667	0.321	2.873	0.244	3.073
19	1.180	1.401	1.074	1.536	0.967	1.685	0.859	1.848	0.752	2.023	0.649	2.206	0.549	2.396	0.456	2.589	0.369	2.783	0.290	2.974
20	1.201	1.411	1.100	1.537	0.998	1.676	0.894	1.828	0.792	1.991	0.692	2.162	0.595	2.339	0.502	2.521	0.416	2.704	0.336	2.885