NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY

FACULTY OF HEALTH, NATURAL RESOURCES AND APPLIED SCIENCES

DEPARTMENT OF AGRICULTURE AND NATURAL RESOURCES SCIENCES

QUALIFICATION: BACHELOR OF SCIENCE IN AGRICULTURE (AGRIBUSINESS MANAGEMENT)	
QUALIFICATION CODE: 07BAGA	**LEVEL:** 7
COURSE CODE: BEA611S	**COURSE NAME:** BASIC ECONOMETRICS FOR AGRICULTURE
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DURATION: 3 HOURS	**MARKS: 100**

FIRST OPPORTUNITY EXAMINATION QUESTION PAPER	
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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 10 PAGES (Excluding this front page)

Section 1 Multiple choice

Questions 1

Which of the following statements is **NOT CORRECT** about Econometrics?

A. There is no difference between econometrics, statistics and mathematics

B. Econometrics empirically measure relationships among economic variables

C. Econometrics is an amalgam of economic theory, mathematical economics, economic statistics and mathematical statistics

D. Econometrics is a collection of statistical techniques for testing economic theories

Question 2

The methods or steps taken in econometrics to estimate economic relationships are as follows:

1. Develop and test a hypothesis
2. Specify the econometrics model.
3. Collect the data.
4. Identify the variables.
5. State the economic theory or hypothesis to be investigated.
6. Do predictions and forecast based on the estimated parameters.
7. Estimate the parameters of the model.
8. Use the model to inform policy.

Which of the following **CORRECTLY** describes the econometrics steps?

A. 2, 5, 4, 3, 8, 1, 7 & 6

B. 4, 2, 6, 5, 7, 1, 3 & 8

C. 5, 2, 4, 3, 7, 1, 6 & 8

D. 5, 2, 1, 3, 7, 4, 6 & 8

Question 3

An economic model is represented by the equation

$Y = a + bX$

Which of the following statements is **NOT** correct?

A. a has no economic interpretation

B. b is the slope while a is the intercept

C. X influences Y according to the value taken by b

D. For the model to be linear X must be raised to the power of two or more

Question 4

Which of the following is **NOT CORRECT** about the name of the variable X in the equation,

$Y = a + bX$

A. Predictor

B. Repressor

C. Independent variable

D. Explanatory variable

Question 5

Which of the following **BEST** describes the models in equations (1) and (2)?

$Y = a + bX$ .....(1)
$Y = a + bX + \varepsilon$ .....(2)

A. Both are the same

B. Equation (1) is used by statisticians whereas, (2) is an econometric model

C. The ε is the disturbance or error term which is a random (stochastic) variable

D. Irrespective of the ε there is an exact relationship between Y and X.

Question 6

An unbiased estimator such as $\hat{\beta}_2$, with the least (minimum) variance is said to be

A) An inefficient estimator

B) An efficient estimator

C) A random noise

D) An asymptote

Question 7

Which of the following statement about R^2 is **NOT** correct?

A. It is a non-negative quantity

B. Its value is between zero and one

C. It is the proportion of Y that is explained by X

D. It is the best estimate of the goodness of fit.

Question 8

Assuming an equation is expressed as

$y_i = \beta_1 + \beta_2 x_1 + \beta_2 x_2 + \mu_i$

Which of the following best describes the formula to test the Hypothesis that β_2 is not statistically different from zero?

A) $t = \hat{\beta}_2 - \beta_2 / se(\hat{\beta}_2)$

B) $t = \beta_2 - \hat{\beta}_2 / se(\hat{\beta}_2)$

C) $t = \beta_2 - \hat{\beta}_2 / se(\beta_2)$

D) $t = \hat{\beta}_2 - \hat{\beta}_2 / se(\hat{\beta}_2)$

Question 9

Instead of using the Null hypothesis to test the significance of an estimate, a shortcut known as the "2-t "rule of thumb can be used. This rule says, "Reject the null that $\beta_2 = 0$ if the computed t-statistics value exceeds

A) Absolute value of three

B) Absolute value of one

C) Absolute value of two

D) Absolute value of four

Question 10

Which of the following is **NOT** an econometric model?

A). $Y_i = \beta_1 + \beta_2\left(\frac{1}{X_i}\right) + \mu_i$

B). $Y_i = \frac{1}{1+e^{\beta_1+\beta_2 X_i+\mu_i}}$

C). $Y_i = \beta_1 + \beta_2^3 X_i$

D). $Y_i = \beta_1 + (0.75 - \beta_1)e^{-\beta_2(X_i-2)} + \mu_i$

Question 11

The relationship between a farmer's consumption expenditure (Y) and income (X) is expressed as follows, $E(y/x_i) = f(x_i)$ .Which of the following statements about the equation is **incorrect**?

A) It is known as the conditional expectation function

B) It is known as the population regression function

C) It is known as the population regression

D) It is known as the sample regression function

Question 12

Which of the following is **incorrect** about the interpretation of the equation $y_i = \beta_1 + \beta_2 x_1 + \beta_2 x_2 + \mu_i$?

A) The expected mean value of y is conditionally related to x_i

B) The values of x are unobservable

C) The expected mean value or average response of Y varies with X

D) The equation of a linear function

Question 13

If an estimable model is given as, $\hat{Y}_i = \hat{\beta}_1 + \hat{\beta}_2 X_i + \hat{\mu}_i$. Which of the following statements is **incorrect**?

A) The equation is a sample regression function

B) The $\hat{\beta}_2$ is the estimator for β_2

C) The value of $\hat{\beta}_2$ is known as the parameter estimate

D) The value of $\hat{\beta}_2$ cannot be negative

Question 14

Which of the following parameters in the equation $\hat{Y}_i = \hat{\beta}_1 + \hat{\beta}_2 X_i + \hat{\mu}_i$ can be calculated using the formula? $\frac{\sum x_i y_i}{\sum x_i^2}$, where $x_i = (X - \overline{X})$ and $y_i = (Y - \overline{Y})$.

A) $\hat{\beta}_2$

B) $\hat{\beta}_1$

C) $\hat{Y}_i$

D) $\hat{\mu}_i$

Question 15

The function $y = f(x)$ is said to be a linear function of (x), which of the following statements is **incorrect** about this linear function?

A) x must appear with power or index of 1 only.

B) x must not be multiplied or divided by any other variable

C) The rate of change of y with respect to x must be independent of the value of x

D) x can appear as a square root ($\sqrt{x}$)

Section 2 True or False

Question 1

The t-test of significance requires that the sampling distribution of estimators follow a normal distribution. True or False

Question 2

Even though the disturbance term is not normally distributed, the Ordinary Least Square estimators are still unbiased. True or False

Question 3

If there is no intercept in the regression model, the estimated error (residual) will not sum to zero. True or False

Question 4

The p-value and the size of a test statistic mean the same thing. True or False

Question 5

In a regression model that contains the intercept, the sum of the residual is always zero. True or False

Section 3 – General

Question 1

Question 1.1. What is the meaning of the following econometrics terms

i).	Intercept (constant)	(1 mark)
ii).	Cross-section data	(1 mark)
iii).	Response variable	(1 mark)
iv).	Linear regression line	(1 mark)

v).	Predictor	(1 mark)
vi).	Linear model	(1 mark)
vii).	Multivariate model	(1 mark)
viii).	Regression analysis	(1 mark)
ix).	Residual	(1 mark)
x).	Slope coefficient	(1 mark)

Question 1.2.

Using hypothetical data, the relationship between child nutrition and stunting was estimated as follows.

$$\hat{Y}_i = \hat{\beta}_1 + \hat{\beta}_2 X_i$$

Where, Y = Average height of pupils aged 5 (measured in meters) and X = Household Dietary Diversity Score (a measure of the diversity of food intake).

The estimated coefficients are

$\hat{\beta}_1 = 0.088$ (0.0412), $\hat{\beta}_2 = 0.7165$ (0.2547), $R^2 = 0.91$.

(Figures in parenthesis are standard errors).

1.2.1. Interpret the slope coefficient	(2 marks)
1.2.2. Calculate the T-statistic for the slope coefficient.	(2 marks)
1.2.3. Calculate the T-statistic for the intercept coefficient	(2 marks)
1.2.4. Interpret the R^2 value	(2 marks)
1.2.5. Give two properties of the coefficient of correlation between Y and X	(2 marks)

Question 2

In a model $y_i = \alpha + \beta x_i + u_i, i = 1,\ldots,N$, the following sample moments have been calculated from 10 observations.

$\sum Y - \bar{Y} = 8$, $\sum X - \bar{X} = 40$, $\sum (Y - \bar{Y})^2 = 26$, $\sum (X - \bar{X})^2 = 200$, and $\sum (X - \bar{X})(Y - \bar{Y}) = 20$

2.1. Estimate the slope parameter (4 marks)

2.2. Estimate the intercept parameter (4 marks)

2.2. Determine the function $\hat{y}$ (3 marks)

2.3. Calculate the value $\hat{y}$ for $x = 10$ (3 marks)

2.4. Obtain the 95% confidence interval for the calculated $\hat{y}$ (6 marks)

Question 3

Consider the following regression model, $y_t = \beta_1 + \beta_2 x_t + \varepsilon_t$. Where, y_t = consumption expenditure, x = income, β_1 = Constant, β_2 = Slope, ε = Error term. Which of the above

3.1. Has fixed values in repeated sampling. (2 mark)

3.2 Is a stochastic variable. (2 mark)

3.3 Is a non-stochastic variable (2 mark)

3.4 Has zero mean in a classical linear regression. (2 mark)

3.5 Is a parameter. (2 mark)

3.6. The analysis of the variance of a regression model is given below.

	df	SS	MS	F	Significance F
Regression	1	-	0.2701	745.9286	0.0000
Residual	-	0.0040	-		
Total	12	0.2741			

i). Complete the table (6 marks)

ii) What is the null hypothesis of this test? (2 marks)

iii) Do you reject or fail to reject this null? Why? (2 marks)

Question 4

A regression analysis (model) to determine the relationship between inventory and sales gives the following post-regression test results.

Description	Statistics
Durbin Watson Statistics	1.8690
Skewness	-0.1639
Kurtosis	1.8084
R-Squared	0.9855
Observation	13
Probability	0.6612

4.1 What is the name of this test? (2 marks)

4.2. Calculate the test statistics for this test (2 marks)

4.3. What is the null hypothesis for this test (2 marks)

4.4. Do you reject or fail to reject this null? Why? (2 marks)

4.5 At 5% probability, using the attached Durbin-Watson Table test whether the residual of this regression is first-order autocorrelated. (4 marks)

4.6. What is the null hypothesis of this test? (2 marks)

4.7. What are the implications of an autocorrelated residual on the parameter estimates of a regression? (6 marks)

Statistical formula

$$\hat{\beta}_1 = \bar{Y} - \hat{\beta}_2 \bar{X}$$

$$\hat{\beta}_2 = \frac{\sum (Y_i - \bar{Y})(X_i - \bar{X})}{(X_i - \bar{X})}$$

$$\hat{\sigma}^2 = \frac{\sum \hat{\mu}_i^2}{n-2}$$

$$\text{var}(\hat{\beta}_2) = \frac{\hat{\sigma}^2}{\sum (X_i - \bar{X})^2}$$

$$\text{var}(\hat{\beta}_1) = \frac{\sum (X_i - \bar{X})^2}{n \sum (X_i - \bar{X})^2}$$

$$R^2 = 1 - \frac{\sum \mu_i^2}{\sum (Y_i - \bar{Y})^2}$$

$$\hat{\beta}_2 = \frac{\sum (Y_i - \bar{Y})(X_i - \bar{X})}{\sum (X_i - \bar{X})^2}$$

$$\hat{\beta}_1 = Y - \hat{\beta}_2 \bar{X}$$

$$se(\hat{\beta}_1) = \sqrt{\frac{\sum X_i^2}{n \sum (X_i - \bar{X})^2}}$$

$$se(\hat{\beta}_2) = \frac{\sigma}{\sqrt{\sum (X_i - X)^2}}$$

$$se(\hat{\beta}_1) = \sqrt{\frac{\sum X_i^2}{n \sum (X_i - \bar{X})^2}} \sigma$$

$$se(\hat{\beta}_2) = \frac{\sigma}{\sqrt{\sum n (X_i - X)^2}}$$

$$JB = n\left[\frac{S^2}{6} + \frac{(K-3)^2}{24}\right]$$

$$JB = n\left[\frac{S^2}{6} - \frac{(K-3)^2}{22}\right]$$

See the attached Dubin Watson table

	$k' = 1$		$k' = 2$		$k' = 3$		$k' = 4$	
n	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
11	0.927	1.324	0.658	1.604	0.595	1.928	0.444	2.283
12	0.971	1.331	0.812	1.579	0.658	1.864	0.512	2.177
13	1.010	1.340	0.861	1.562	0.715	1.816	0.574	2.094
14	1.045	1.350	0.905	1.551	0.767	1.779	0.632	2.030
15	1.077	1.361	0.946	1.543	0.814	1.750	0.685	1.977
16	1.106	1.371	0.982	1.539	0.857	1.728	0.734	1.935
17	1.133	1.381	1.015	1.536	0.897	1.710	0.779	1.900
18	1.158	1.391	1.046	1.535	0.933	1.696	0.820	1.872

END