BINDURA UNIVERSITY OF SCIENCE EDUCATION

FACULTY OF COMMERCE

DEPARTMENT OF ECONOMICS

PROGRAMMES: BSc HONOURS DEGREE IN ECONOMICS

EC 206: INTRODUCTION TO ECONOMETRICS

DURATION: 3 HOURS

INSTRUCTIONS:

1. Answer all questions

2. NO CELLPHONES ALLOWED IN THE EXAMINATION ROOM.

Question 1

The following information is available regarding average tomato price in ZWL per kilogram at Mbare Musika farmer's market and average winter temperatures for Harare, Zimbabwe from 2007 to 2020.

Year	Price/kg in ZWL	Winter temp (degrees celcius)
2007	8.10	13.2
2008	4.16	9
2009	6.41	11.78
2010	4.53	13.3
2011	5.71	23.4
2012	5.12	15
2013	5.14	14.6
2014	3.88	11.77
2015	3.66	16.3
2016	3.57	12.8
2017	3.87	13
2018	3.84	11.2
2019	4.09	18
2020	5.1	16

a. Identify and justify your dependant and independent variables. **(2 marks)**

b. Draw a scatter plot and superimpose a regression line for the data. **(4 marks)**

c. Use ordinary least squares to obtain estimates for the parameters. **(8 marks)**

d. Find estimates of the standard errors for both parameters. **(8 marks)**

e. How would you test the assumption of the normality of the error term? **(5 marks)**

Question 2

Consider the standard simple regression model; $Y = a + bX + u$ under the Classical Linear Regression Model Assumptions. Let $\hat{a}$ and $\hat{b}$ be the estimator of a and b respectively.

    a. Derive the OLS estimators for parameters a and b. **(5 marks)**

    b. Show that $\hat{b}$ is an unbiased estimator of b **(5 marks)**

    c. Derive the variance of $\hat{b}$ **(7 marks)**

    d. Show that $\hat{b}$ has the minimum variance. **(8marks)**

Question 3

a. A joint log-linear model is given as

$$\log L = -n\log \sigma_u^2 - \frac{n}{2}\log 2\Pi - \frac{1}{2\sigma_u^2}\sum(Y - a - bX)^2$$

    i. Derive the normal equations under the maximum likelihood estimation. **(7 marks)**

    ii. Derive the variance of the residuals under MLE and show that it is biased for small samples. **(10 marks)**

b. Briefly explain each of the following terms as they relate to econometrics.

    i) Coefficient of determination
    ii) Autocorrelation
    iii) Dummy variable trap. **(8 marks)**

Question 4

a. In a simple econometric model of the form $Y = a + \ell X + m$, derive the variance of a.

(10 marks)

b. Derive the variance of the error term σ_m^2

(10 marks)

c. Given that $\hat{\ell} = \dfrac{\sum xy}{\sum x^2}$, prove that $\hat{\ell} = \dfrac{\sum xY}{\sum X^2 - n\bar{X}^2}$

(5 marks)

END OF PAPER