CHUKA **UNIVERSITY**

UNIVERSITY EXAMINATIONS

THIRD YEAR EXAMINATION FOR THE AWARD OF DEGREE OF BACHELOR OF SCIENCE IN ECONOMICS AND STATISTICS, BACHELOR OF ARTS IN ECONOMICS AND SOCIOLOGY, BACHELOR OF ARTS IN ECONOMICS AND MATHEMATICS AND BACHELOR OF ARTS IN ECONOMICS AND HISTORY

ECON 336: ECONOMETRICS I

STREAMS: Y3S1 **TIME: 2 HOURS**

DAY/DATE: FRIDAY 13/12/2019 **8.30 A.M. – 10.30 A.M.**

INSTRUCTIONS:

- **Answer question ONE and any other TWO questions from the remaining.**

QUESTION ONE

A researcher is using data for a sample of 88 houses sold in Nairobi Runda estate during a recent year to investigate the relationship between house price Y_i(Measured in thousands of dollars) and house size Y_i(Measured in square meters). Preliminary analysis of the sample produces the following information: $N = 88$

$\sum_{i=0}^{n} Y_i = 25{,}832.05$ $\sum_{i=0}^{n} X_i = 16{,}462.3$ $\sum_{i=0}^{n} Y_i^2 = 8{,}500{,}750.60$

$\sum_{i=0}^{n} X_i^2 = 3{,}329{,}789.60$ $\sum_{i=10}^{n} X_i Y_i = 5{,}209{,}990.70$ $\sum_{i=10}^{n} x_i x_i = 377{,}534.76$

$\sum_{i=0}^{n} y_i^2 = 977{,}854.51$ $\sum_{i=0}^{n} x_i^2 = 250{,}144.32$ $\sum_{i=0}^{n} \hat{\mu}_i^2 = 348{,}058.43$

Where $x = X_i - \bar{X}$ $y = Y_i - \bar{Y}$ for all $i = 1, 2, 3 \ldots\ldots\ldots\ldots N$. Use the above information to answer the following questions. Show explicitly all formulas and calculations.

(i) Use the above information to compute ordinary least square estimates of the intercept co-efficient β_1 and the slope co-efficient β_2. (10 marks)

(ii) Interpret the slope co-efficient estimate you calculated above. Explain what the numeric value you calculated for $\hat{\beta}_2$ means. (5 marks)

(iii) Compute the estimate of error variance σ^2. (4 marks)

(iv) Compute the value of R^2 the co-efficient of determination for the estimated OLS sample regression equation. Briefly explain what the calculated value of R^2 means. (5 marks)

(v) Perform a test of the null hypothesis $H_0: \hat{\beta}_2 = 0$ against the alternative hypothesis $H_1: \hat{\beta}_2 \neq 0$ at the 5% significance level (i.e. for significance level $\propto = 0.05$). Show how you calculate the test statistic. State the decision rule you use, and the inference you would draw from the test. Briefly explain what the test outcome means. (6 marks)

QUESTION TWO

(i) State the Ordinary Least Square (OLS) estimate criterion. (3 marks)

(ii) State the OLS normal equations for a univariate regression model. (4 marks)

(iii) Derive the OLS normal equations from the OLS estimate criterion in (i) above.(8 marks)

(iv) From the normal equations derived above, compute Ordinary Least Square estimators for a univariate regression model. (5 marks)

QUESTION THREE

(i) Give a general definition of t-distribution. (2 marks)

(ii) Starting from the definition in (i) above derive the t-statistics for the OLS slope co-efficient estimator β_2. (5 marks)

(iii) State and explain five major assumptions of Classical Linear Regression Model (CLRM) (10 marks)

(iv) State the Gauss-Markov theorem. Explain fully what it means. (3 marks)

QUESTION FOUR

To examine the impact of newspaper advertisement expenditure X_i and television adverstiment Expenditure X_2 on sales revenue Y. An econometrician specified the regression model given below.

$$Y = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \epsilon_i$$

Using the following annual data covering a period of 10 years (all data values are in millions of dollars)

Y	10	25	40	55	60	70	75	80	80	95
X_1	0.5	1.0	2.0	3.5	3.5	4.5	4.5	4.0	5.0	5.5
X_2	1.0	2.0	2.5	4.0	3.5	5.5	6.0	7.0	7.5	8.0

(i) Obtain OLS estimates of the parameters of the model. (4 marks)

(ii) Interpret the co-efficients. (2 marks)

(iii) Calculate the predicted values and residuals for the multiple regression model given above, verify that the sum of all the residuals is equal to zero. (5 marks)

(iv) Calculate total sum of squares (SST), regression sum of squares (SSR) and error sum of squares (SSE) for the above regression model. (6 marks)

(v) Use the above data to calculate co-efficient of multiple determination R^2 and interpret its value. (3 marks)

QUESTION FIVE

Given the following statistical relationship,

$\sum_{i=1}^{n} X_i = N\bar{X} \sum_{i=1}^{n} Y_i = N\bar{Y}$

$\sum_{i=1}^{n}(X_i - \overline{X})(Y_i - \overline{Y}) = \sum_{i=1}^{n} Y_i(X_i - \bar{X}) = \sum_{i=1}^{n} X_i(Y_i - \overline{Y})$

Show that:

(i) $\hat{\beta} = \frac{\sum_{i=1}^{n} X_i Y_i - N\overline{X_\iota Y_\iota}}{\sum_{i=1}^{n} X_i^2 - N\overline{X_\iota}}$ or $\beta = \frac{cov(X_i Y_{i)}}{var(X_i)}$ (10 marks)

(ii) $\hat{\propto} = \bar{Y} - \hat{\beta}\bar{X}$ (10 marks)
