



**JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY
SCHOOL OF AGRICULTURAL AND FOOD SCIENCES**

**THIRD YEAR FIRST SEMESTER UNIVERSITY EXAMINATION FOR DEGREE
OF BACHELOR OF SCIENCE IN AGRIBUSINESS MANAGEMENT**

2022/2023 ACADEMIC YEAR

REGULAR

COURSE CODE: AAE 3311

COURSE TITLE: Quantitative Methods in Agricultural Economics 1

EXAM VENUE: **STREAM:** BSc. (Agribusiness Management)

DATE: **EXAM SESSION:**

TIME: 2.00 Hours

Instructions:

- 1. Answer ALL questions in Section A (compulsory) and ANY other TWO questions in Section B.**
- 2. Candidates are advised not to write on the question paper.**
- 3. Candidates must hand in their answer booklets to the invigilator while in the examination room.**

SECTION A [30 MARKS]

Answer ALL questions from this Section.

1. You are organizing a tree-planting event for next week and believe attendance will depend on the weather. Do you consider the following possibilities are appropriate

Weather	Probability = $f(x)$	Attendance = X
Terrible weather	0.2	500
Mediocre weather	0.6	1000
Great weather	0.2	2000

- Let X denote the attendance. Why is X a random variable? [2 Marks]
 - What is the expected attendance? [2 Marks]
 - Suppose that each tree seedling costs \$5 and that the total cost of giving the tree planting event is a fixed \$2,000. Let $Y = \text{profit} = \text{total sales revenue} - \text{total cost} = 5X - 2000$. What is the expected profit? [2 Marks]
2. State the assumptions of the simple linear regression model. [6 Marks]
3. State the Gauss–Markov Theorem [3 Marks]
4. A Mango juice vendor at JOOUST University football games observes that the more Mango juices are sold the warmer the temperature at game time is. Based on 32 home games covering five years, the vendor estimates the relationship between Mango juice sales and temperature to be $y = -240 + 8x$, where $y =$ the number of Mango juices she sells and $x =$ temperature in degrees Fahrenheit,
- Interpret the estimated slope and intercept. Do the estimates make sense? Why, or why not? [6 Marks]
 - On a day when the temperature at game time is forecast to be 80°F , predict how many Mango juices the vendor will sell. [3 Marks]
 - Below what temperature are the predicted sales zero? [3 Marks]
 - Sketch a graph of the estimated regression line. [[3 Marks]

SECTION B [40 MARKS]

Answer any TWO questions from this Section.

5. Consider the following observations. You are to do all the parts of this question using only a calculator.

X	12	11	10	23	11	14	15
Y	20	40	50	70	10	40	20

- What are the sample means of x and y ? [2 Marks]
- Compute the least squares estimates of the slope and the intercept and state their interpretation. [5 Marks]
- Compute the variance of the random error term, σ_2 . [2 Marks]
- Compute the variance and the standard errors of the least square estimates b_1 and b_2 . [4 Marks]
- Compute the covariance of the least estimates b_1 and b_2 . [3 Marks]
- Explain the central limit theorem. [5 Marks]

6. In an estimated simple regression model, based on 24 observations, the estimated slope parameter is 0.310 and the estimated standard error is 0.082.
- Test the hypothesis that the slope is zero against the alternative that it is not, at the 1% level of significance. [3 Marks]
 - Test the hypothesis that the slope is zero against the alternative that it is positive at the 1% level of significance. [3 Marks]
 - Test the hypothesis that the slope is zero against the alternative that it is negative at the 5% level of significance. Draw a sketch showing the rejection region. [3 Marks]
 - Test the hypothesis that the estimated slope is 0.5, against the alternative that it is not, at the 5% level of significance. [3 Marks]
 - Describe three ways in which statistical inferences are carried out. [5 Marks]
7. Consider the following estimated regression equation (standard errors in parentheses):

$$Y = 5.83 + 0.869X$$

$$se \quad (1.23) \quad (0.117)$$

$$R^2 = 0.756$$

Rewrite the estimated equation that would result if

- All values of x were divided by 20 before estimation [4 Marks]
- All values of y were divided by 50 before estimation. [3 Marks]
- All values of y and x were divided by 20 before estimation. [3 Marks]
- Supposing that a simple regression has quantities $\sum(y_i - \bar{y})^2 = 631.63$ and $\sum \hat{e}_i^2 = 182.85$ find R^2 . [3 Marks]
- Suppose that a simple regression has quantities $N = 20$, $\sum y_i^2 = 5930.94$, $\bar{y} = 160.35$, and $SSR = 666.72$, find R^2 . [3 Marks]
- Suppose that a simple regression has quantities $R^2 = 0.7911$, $SST = 552.36$, and $N = 20$, find $\hat{\sigma}^2$. [4 Marks]