



KISII UNIVERSITY
UNIVERSITY EXAMINATIONS

THIRD YEAR EXAMINATION FOR THE AWARD OF THE DEGREE OF
BACHELOR OF SCIENCE IN AGRICULTURE
SECOND SEMESTER, 2023/2024
(JANUARY-APRIL, 2024)

AGRO 391: AGRICULTURAL EXPERIMENTATION

STREAM: Y3 S2

TIME: 2 HOURS

DAY: THURSDAY, 3:00 – 5:00 P.M.

DATE: 11/04/2024

INSTRUCTIONS

- 1. Do not write anything on this question paper.**
- 2. Attempt ALL questions in Section A and ANY TWO in Section B.**

- i. Define the following terms as used in agricultural experimentation
 - a. Hypothesis (2 marks)
 - b. Variable (2 marks)
 - c. Type I error (2 marks)
 - d. Experimental unit (2 marks)
 - e. Randomization (2 marks)
- ii. State three principles of experimentation (3 marks)
- iii. When do you use the Latin square design in an agricultural experimentation (2 marks)
- iv. Briefly state randomization steps for the layout of a completely randomized design. (5marks)

QUESTION TWO

In an experiment to compare the yield potential of four (4) sweet potato varieties in a certain area. The researcher decided to set up the experiment in an RCB design with four replication. After data collection and statistical analysis, the following ANOVA table was constructed.

Source of variation	DF	Sum of Squares (SS)	Mean sum of squares (MSE)	F
Replications	3	26.36	-	-
Treatments	3	216.23	-	-
Error	-	57.95	-	
Total	15	300.54		

$F_{3,12}(\alpha=0.05) = 3.49$

- i.
- ii. Why did the researcher replicate the experiment four times (2 marks)
- iii. Give the linear model for the design and explain all the terms used (4 marks)
- iv. What are the sources of variation for this design (3 marks)
- v. Complete the sample ANOVA table above; (6 marks)
- vi. Do you reject or fail to reject the null hypothesis? Explain. (3 marks)
- vii. What is conclusion can one make about this experiment in terms of the yield of sweet potato varieties. (2 Marks)

SECTION B: ANSWER ANY TWO QUESTIONS IN THIS SECTION

QUESTION THREE

In an agricultural experiment, an area of land was divided into 16 plots in a 4 x 4 arrangement. Four herbicide-insecticide treatments, A, B, C and D, were applied according to Latin square design. The numbers given are the observed crop yields.

	Treatment: Yield				Row Total
	D:44	C:40	B:30	A:29	143
C:38	B:32	A:26	D:43	139	
B:35	A:28	D:41	C:39	143	
A:24	D:45	C:39	B:35	143	
Column Total	141	145	136	146	568

Statistical analysis was carried out using one of the statistical analysis and the following out/result was obtained.

The GLM Procedure

Class	Level	Information
Class	Levels	Values
row	4	1 2 3 4
column	4	1 2 3 4
treat	4	A B C D
Number of observations		16

Dependent Variable: yield

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	9	639.0000000	71.0000000	17.04	0.0013
Error	6	25.0000000	4.1666667		
Corrected Total	15	664.0000000			

R-Square	Coeff Var	Root MSE	Yield Mean
0.962349	5.749976	2.041241	35.50000

Source	DF	Type III SS	Mean Square	F Value	Pr > F
treat	3	620.5000000	206.8333333	49.64	0.0001
row	3	3.0000000	1.0000000	0.24	0.8655
column	3	15.5000000	5.1666667	1.24	0.3749

The GLM Procedure

t Tests (LSD) for yield

NOTE: This test controls the Type I comparisonwise error rate, not the experimentwise error rate.

Alpha	0.05
Error Degrees of Freedom	6
Error Mean Square	4.166667
Critical Value of t	2.44691
Least Significant Difference	3.5318

Means with the same letter are not significantly different.

t Grouping	Mean	N	treat
A	43.250	4	D
B	39.000	4	C
C	33.000	4	B
D	26.750	4	A

- (a) What are the sources of variation for this design (4 marks)
 (b) Summarize the above information in ANOVA table (4 marks)

- (c) Is there any significant differences among the treatments, use $\alpha=0.05$? Give reason for your answer. (3 marks)
- (d) If yes in (c), which treatments were significantly different from each (2 marks)
- (e) What conclusion can we make from this experiment? (2 marks)

QUESTION FOUR

- a. Define an independent variable (2 marks)
- b. State the first four basic concepts of experimental design (4 marks)
- c. Given the following data below obtained for two pairs of variables X_1 and X_2

X_1	4	4	5	5	4	6	5
(X_2)	2	3	3	4	4	4	4

- i. Define Correlation coefficient (r^2) (2 marks)
- ii. Find the coefficient of linear correlation between variables X_1 and X_2 (5 marks)
- iii. What conclusion do you make about the two variables X_1 and X_2 (2 marks)

QUESTION FIVE

The data in the following table come from a controllable experiment on the effects of different amounts fertilizers on the yields of potatoes

Amount (X)	0	4	8	12
Yield (Y)	8.34	8.89	9.16	9.50

- i. Define regression analysis [2 Marks]
- ii. Draw a scatter plot for the above data [3 Marks]
- iii. What are the data assumptions when carrying out regression analysis [3 Marks]
- iv. Work out the intercept and the slope of the line between the two variables [4 Marks]
- v. Give the equation for the line [1 Marks]
- vi. What is the value of Y if $X=5$ [1 Marks]