

CHUKA



UNIVERSITY

## UNIVERSITY EXAMINATIONS

**FIRST YEAR EXAMINATION FOR THE AWARD OF DEGREE OF  
DOCTORATE OF PHILOSOPHY IN AGRONOMY, DOCTORATE OF  
PHILOSOPHY IN AGRICULTURAL EXTENSION AND DOCTORATE OF  
PHILOSOPHY IN AGRIBUSINESS MANAGEMENT**

**MATH 900: ADVANCED BIOMETRY****AGBM 931: STATISTICS FOR RESEARCHERS****AGEX 902: ADVANCED STATISTICAL METHODS IN AGRICULTURAL  
EXTENSION EDUCATION****STREAMS: PhD****TIME: 3 HOURS****DAY/DATE: THURSDAY 08/04/2021****8.30 A.M. – 11.30 A.M.****INSTRUCTIONS**

- *Answer question one and any other two questions*
- *Use of calculators and statistical tables is allowed*
- *Do not write on the question paper*

**Question one: (20 marks): compulsory**

(a) The following computer output show two sets of the analysis of results from an experiment on the effect of pinching and fertilizer application on butternut fruit yield.

Interpret the two outputs. (13 marks)

**Model I-Response variable: Butternut fruit yield****Analysis of variance**

source	df	SS	MS	F-Value
Regression	1	6950.86993	6950.86993	653.89
Error	88	935.43760	10.62997	
<b>Total</b>	<b>89</b>	<b>7886.30754</b>		

**Summary statistics**

Root MSE	3.26036	R-Square	0.8814
Dependent	16.84810	Adj R-Sq	0.8800
Coeff. Var.	19.35152		

**Estimates of regression coefficients**

source	df	estimate	stdError	t
Intercept	1	4.41975	0.59526	7.42
Fertilizer	1	6.21417	0.24301	25.57

**Model II-Response variable: Butter fruit yield**

**Analysis of variance**

source	df	SS	MS	F-Value
Regression	2	7164.60834	3582.30417	431.84
Error	87	721.69920	8.29539	
Total	89	7886.30754		

**Summary statistics**

Root MSE	2.88017	R-Square	0.9085
Dependent Mean	16.84810	Adj R-Sq	0.8800
Coeff. Var.	17.09494		

**Estimates of regression coefficients**

Variable	df	estimate	stdError	t
Intercept	1	2.53235	0.64403	3.93
Fertilizer	1	6.21417	0.21468	28.95
Packaging	1	1.88741	0.37183	5.08

(b) Discuss the various types of data measurements and data organization methods.

(7

marks)

**Question two (20 marks)**

A researcher designed an experiment to study the growth of a particular strain of bacteria. It is suspected that the bacteria growth is influenced by temperature and environment and thus the researcher carried out the experiment at four different temperatures and three levels of nutrient medium. Due to the length of time required to observe the bacteria growth, the experiment was replicated over five days with the days forming blocks.

Temperature/ Nutrient	T1	T2	T3	T4
N <sub>1</sub>	74.8	89.0	96.6	102.2
N <sub>2</sub>	78.4	99.8	109.2	112.5
N <sub>3</sub>	78.1	94.6	98.6	105.9

- (a) Give a statistical model (2 marks)
- (b) Analyze the following results which represent totals over the five days and draw appropriate conclusions given that TSS = 959.35 and SSR = 421.6. Take  $\alpha = 0.05$ . (14 marks)
- (c) Apply one of the mean separation procedures in the above analysis. Take  $\alpha = 0.05$ . (4 marks)

**Question three (20 marks)**

A survey was carried out to find out the effect of cookies packaging using three packaging technologies (P1, P2 and P3) on sales margin over two periods (January-March and April-June). Carry out an analysis of variance of data combined over the periods. Take  $\alpha = 0.05$ .

Season	Replication	P1	P2	P3
January-March	1	4.9	6.0	6.7
	2	2.6	6.6	6.7
	3	4.5	5.7	6.8
April-June	1	5.0	6.4	6.1
	2	3.5	6.3	6.0
	3	5.4	6.6	5.9

**Question four (20 marks)**

An experiment with three replications was conducted to test the effect of tilling method on yield of maize crop. Three different tiling methods (hand, oxen and tractor) and three maize hybrids (H614, H626 and H628) were used.

Methods	Replicate	H614	H626	H628
Tractor	1	66.3	64.5	74.1
	2	65.0	65.2	73.8
	3	66.5	66.2	72.3
Oxygen	1	68.2	69.5	73.8
	2	69.2	70.3	74.5
	3	69.0	69.0	75.4
hand	1	70.3	73.1	78.0
	2	71.2	72.8	79.1
	3	70.8	74.2	80.1

(a) With justification, giving a statistical model. (3 marks)

(b) Analyse the data to test an appropriate hypothesis using a split-plot design. Take  $\alpha = 0.05$ . (17 marks)