

CHUKA



UNIVERSITY

UNIVERSITY EXAMINATIONS

**EXAMINATION FOR THE AWARD OF DEGREE OF DOCTOR OF PHILOSOPHY IN
SOIL SCIENCE**

MATH 900: ADVANCED BIOMETRY

STREAMS:

TIME: 3 HOURS

DAY/DATE : THURSDAY 15/07/2021

2.30 P.M – 5.30 P.M

INSTRUCTION

**Answer Question ONE and any TWO questions
Use of calculators and statistical table is allowed
Do not write anything on the question paper**

QUESTION ONE

- (a) Discuss two uses of analysis of Covariance (ANCOVA) in agricultural experiments.

[4

marks]

- (b) A researcher would like to carry out a long term experiment involving eight types of crops such that there are three levels of Nitrogen (N), three levels of phosphorus (P) and four levels of watering plan. The researcher is not sure of the type of design to use in this experiment. Advise the researcher, clearly indicating the model. [6 marks]

- (c) The following computer outputs 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. [10 marks]

Model 1 –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	
Total	89	7886.30754		

Summary statistics

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

Estimate of regression coefficients

Variable	df	Estimate	Std Error	t
Intercept	1	4.41975	0.59526	7.42
Fertilizer	1	6.21417	0.24301	25.57

Model II – Response variable: Butternuts 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	0.9064

Coeff Varr	17.09494
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Estimates of regression coefficients

Variable	df	Estimate	Std Error	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

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 this 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 days forming blocks.

Temperature /nutrient	T_1	T_2	T_3	T_4
N_1	74.8	89.0	96.6	102.2
N_2	78.4	99.8	109.2	112.5
N_3	78.1	94.6	98.6	105.9

(a) Giving 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)

An experiment with three levels of nitrogen was carried out over two seasons. Carry out an analysis of variance of data combined over seasons.

Season	Rep	N_0	N_{60}	N_{90}
Dry	1	14.9	16.0	16.7
	2	12.6	16.6	16.7
	3	14.5	15.7	16.8
Wet	1	15.0	16.4	16.1
	2	13.5	16.3	16.0
	3	15.4	16.6	15.9

QUESTION FOUR (20 MARKS)

An experiment with three replications was conducted to test effect of tilling method on yield of sorghum crop. Three different tiling methods (hand, oxen and tractor) and three sorghum varieties (Mugeto, seredo and H517 serena) were used.

Methods	Replicate	Mugeto	Seredo	Serena
Tractor	1	29.5	38.7	47.3
	2	26.2	35.4	45.0
	3	27.7	37.4	43.5
Oxen	1	32.4	44.9	49.0
	2	30.4	41.5	45.7
	3	29.2	38.2	44.6
Hand	1	40.5	52.3	58.2
	2	37.4	49.0	55.3
	3	37.0	50.4	56.3

Using an appropriate experimental design, analyze the data to test your stated hypotheses. Take $\alpha = 0.05$.
