



GWANDA STATE UNIVERSITY
FACULTY OF LIFE SCIENCES
DEPARTMENT OF CROP SCIENCE
BACHELOR OF SCIENCE HONOURS DEGREE IN CROP/ANIMAL SCIENCE
LCS 1202 RESEARCH METHODS IN AGRICULTURE
FIRST SEMESTER EXAMINATION PAPER
NOVEMBER 2019

Time Allowed: 3 hours

Total Marks: 100

Special Requirements: Non-Programmable Calculator (provided by the student), Statistical Tables (provided by Department of Crop Science), Graph Papers (provided by Exams Board)

Examiner: Mr. R. Mapuranga

INSTRUCTIONS

1. Answer **all** questions in Section A
2. Answer **only two** questions in Section B

MARK ALLOCATION

QUESTION	MARKS
SECTION A	40
SECTION B	60
TOTAL ATTAINABLE MARKS	100

Copyright: GWANDA STATE UNIVERSITY 2019

SECTION A: ANSWER ALL QUESTIONS FROM THIS SECTION

[40 marks]

1. Define the following terms:

- a. Experiment [1 Mark]
- b. Experimental unit [1 Mark]
- c. Non-parametric statistics. [1 Mark]
- d. Residual [1 Mark]
- e. Contingency table [1 Mark]

2. What is the difference between the following:

- a. An experimental design and a factorial treatment structure? [2 Marks]
- b. A complete block design and an incomplete block design? [2 Marks]
- c. Open ended and closed ended questions [2 marks]

3. Randomization, Replication and Blocking are the three underlying principles of experimental design. Define these three principles and state one reason for each, why they must be used in an experiment to make it valid. [6 Marks]

4. List two types of appropriate graphical displays and two types of appropriate methods of location for each of the following levels of measurement:

- a. Ordinal; [2 Marks]
- b. Ratio. [2 Marks]

5. The following are the yields in kg per plot of 100m² for four cotton varieties.

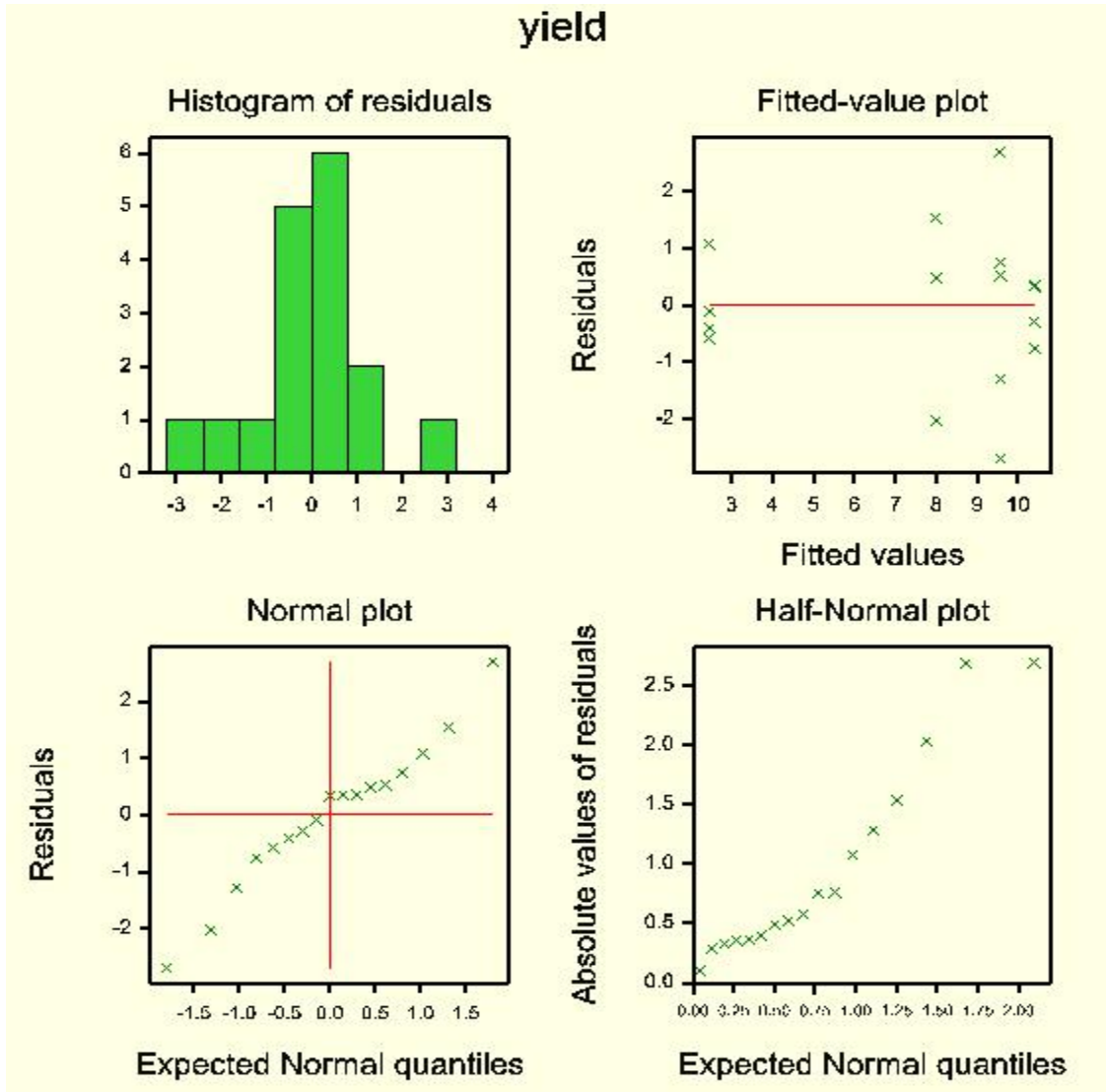
Variety	Plot yields (kg)	Reps	Total	Mean
CRIMS1	2.36, 2.06, 1.88, 3.54	4	9.84	2.46
CRIMS2	10.32, 10.09, 8.28, 6.88, 12.26	5	47.83	9.57
SZ9314	10.77, 10.76, 10.12, 10.74, 9.65	5	52.04	10.41
LS9214	9.54, 5.97, 8.49	3	24	8
Total		17	133.71	
Grand mean				7.87

The following output was produced in the Genstat from analyzing these data

Analysis of variance

Variate: yield

Source of variation	d.f.	s.s.	m.s.	v.r.	F pr.
Variety	3	_____	54.571	_____	<.001
Residual	_____	26.397	_____		
Total	16	190.109			



Using the information in the output above, answer the following questions:

- What is the experimental design for this experiment? Give a reason for your answer [2 Marks]
- Give the model of the design you identified in (a) above [2 Marks]
- List two advantages and two disadvantages of this design [4 Marks]
- Copy and complete the ANOVA table [2 Marks]
- Test the significance difference among the varieties [4 Marks]

- f. Give the assumption being tested by each residual plot and say whether the data meets the assumption or not [8 Marks]

SECTION B: ANSWER ANY TWO QUESTIONS IN THIS SECTION

[60 Marks]

6 (a) The research process involves several different steps and issues, write down short notes on:

- i. Ethics in research [3 Marks]
- ii. Hidden replication [3 Marks]
- iii. Posthoc analysis or mean comparison [3 Marks]
- iv. SMART objectives [3 Marks]

(b) i. Define the term “data transformation” [2 Marks]

ii. Copy and complete the following table [6 Marks]

Data transformation method	Conditions under which it is used
1.
2.
3.

(c) State the five (5) steps to be followed when formulating a research problem in their order [7 Marks]

- 7. (a) i. What is the difference between sampling errors and non sampling errors [4 Marks]
- ii. What is the difference between a rank and a score [4 Marks]
- iii. List any four types of sampling used in agriculture [4 Marks]
- iv. Give four features of well developed questions for use in a survey [4 Marks]

(b) In the following dataset, focus group discussions were held in a community and the different farming techniques that each household uses were discussed and determined for each household. A seasonal calendar was developed for the amount of food that was available to each household. The following table gives the number of households which fall into each category.

Farming technique	Amount of food available		
	0 – 4 months	5 – 8 months	9 – 12 months
Technique A	12	8	5
Technique B	3	10	15

- i. Test to see whether the amount of food available in the household is independent of the farming technique employed. Use the Chi Square test of independence [12 Marks]
- ii. List two (2) assumptions utilized by Chi Square test [2 Marks]

8. The following data are the yields in kilograms per hectare for four cotton varieties. The design used in this experiment was Randomized Complete Block Design (RCBD).

Variety	Block				Variety total	Variety means
	1	2	3	4		
CRIMS1	3.54	1.88	2.06	2.36	9.84	2.46
CRIMS2	12.26	8.28	10.09	10.32	40.95	10.24
SZ9314	10.77	10.76	10.12	10.74	42.39	10.60
LS9202	9.54	5.97	6.88	8.49	30.88	7.72
Block total	36.11	26.89	29.15	31.91	124.06	

- a. Give 2 (two) advantages and 2 (two) disadvantages of RCBD. [4 Marks]
- b. Analyze the data and test whether the blocking was effective and whether there was a difference in the yields between the varieties. You are given that $\sum y_i^2 = 1148.655$ and $(\sum y_i)^2 = 15390.9$ [21 Marks]
- c. Calculate the 5% least significant difference (LSD) for the means and show which means are significantly different (if any) [5 Marks]

***** End of Examination *****
