



GWANDA STATE UNIVERSITY
FACULTY OF LIFE SCIENCES
DEPARTMENT OF CROP SCIENCE
BACHELOR OF SCIENCE HONOURS DEGREE IN CROP SCIENCE
LCS 1102 BIOMETRY
FIRST SEMESTER EXAMINATION PAPER
NOVEMBER 2019

Time Allowed: 3 hours
Total Marks: 100
Examiner: Mr. R. Mapuranga
Requirements: Non-Programmable Calculator (provided by the student),
Statistical Tables (provided by Department of Crop
Science), Graph Papers (provided by Exams Board)

INSTRUCTIONS

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

MARK ALLOCATION

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

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SECTION A: ANSWER ALL QUESTIONS

[40 marks]

1. Define the following words
 - a. Biometry [1]
 - b. Continuous random variable [1]
 - c. Skewness [1]
 - d. Mode [1]
 - e. Histogram [1]
 - f. Parameter [1]
2. What is the difference between the following
 - a. Precision and accuracy [2]
 - b. S^2 and σ^2 [2]
 - c. Cluster sampling and stratified sampling [2]
3. An investigator at Makoholi Research Centre recorded the following data on testes weight of Mashona bulls (one unit of the pair) in grams.

110	110	110	110	110	110	111	111	111	112
112	112	113	113	114	114	114	117	117	117
118	118	118	120	121	121	122	123	123	125
126	126	126	128	128	128	128	129	130	130

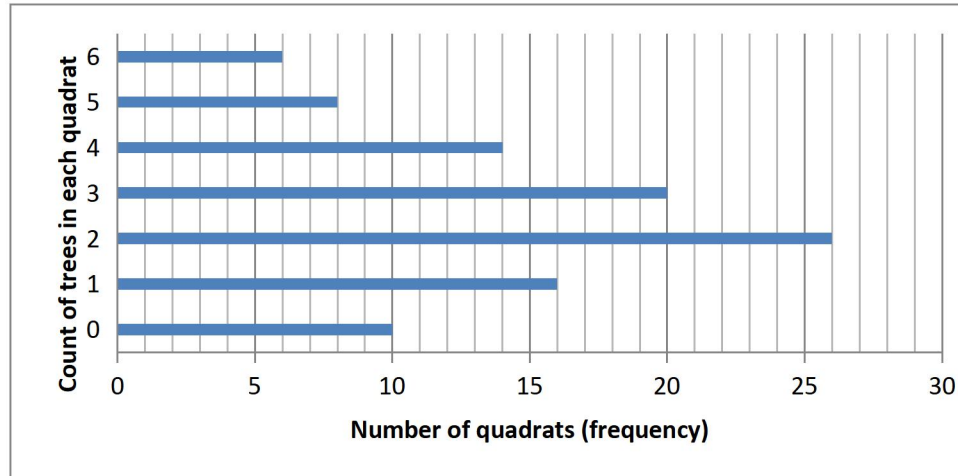
- a. Calculate the following statistics for the data
 - i. Mean, median and mode [6]
 - ii. Minimum, maximum and range [3]
 - iii. Q_1 and Q_3 [2]
- b. Based on weight data on testes above, complete the following frequency distribution table [12]

Category (in grams)	Frequency	Cumulative frequency	Percent frequency	Cumulative percent frequency
110 – 115				
116 – 120				
121 – 125				
126 – 130				
Total	40		100	

- c. Draw a histogram for this data [5]

SECTION B: ANSWER THREE (3) QUESTIONS FROM THIS SECTION [60 MARKS]

4 The following bar-chart gives the spatial distribution of some tree species in a communal grazing land in Bulilima District (hypothetical data) in randomly placed quadrats



(a) Copy and complete the table below using the bar-chart [3.5]

Count of trees	0	1	2	3	4	5	6
Number of quadrats (frequency)							

(b) How many quadrats were sampled? [0.5]

(c) What was the total number of trees counted [2]

(d) Find the average number of trees per quadrat. [3]

(e) Assuming a Poisson distribution, use the average calculated in (iv) to calculate expected probabilities for the number of quadrats with each tree count. [7]

(f) Test, using the Chi-Square Goodness-of-Fit Test, whether the trees in the communal grazing land are randomly distributed. [4]

5 (a) An experiment was carried out to investigate the effect of an enzyme on the rate of uptake in rat liver cells. Livers from five rats were prepared and the suspension from each liver was divided into two. One half had the rate of oxygen uptake measured in the presence of the enzyme and the other half had the rate of oxygen uptake measured in the absence of the enzyme. The data are as follows:

Condition	Rat number				
	1	2	3	4	5
Enzyme present	295	319	306	303	305
Enzyme absent	350	333	342	310	327

- i.** Explain why this is a matched-pairs experiment. **[2]**
 - ii.** Test the null hypothesis that there is no difference in the oxygen uptake between liver suspensions with and without the enzyme. Use a paired-sample t-test. Take the sample standard deviation (s) to be 19.1 **[12]**
 - iii.** List any other two (2) types of t-tests? **[2]**
- (b)** A veterinary doctor vaccinating farm animals knows from experience that 10% of the animals to whom he administers the drug will suffer undesirable side effects. Find the probability that exactly 2 out of 6 calves will suffer side effects after being vaccinated. **[4]**

6 **(a)** An experiment was carried out to test a fish-oil for its Vitamin D potency. Twenty chicks were fed a diet which included the fish oil with a basic mash and ten chicks were fed a diet which had the same basic mash and the standard cod-liver oil with known Vitamin D potency (Mead *et al.*, 1993). The data are as follows:

Standard (10)	Unknown (20)	
69	68	65
66	69	63
71	66	66
69	64	68
68	67	66
71	69	72
74	65	69
69	71	67
73	68	66
70	70	61

- i.** Calculate the mean, standard deviation and standard error for each group. **[6]**
- ii.** Use an F-Test to test the equality of the variances between the two groups. **[6]**

(b) From a large field of maize, 714 ears were collected in a random fashion. Each ear was measured to the nearest centimeter.

Class interval	Frequency
10-11	8
12-13	60
14 – 15	100
16 – 17	220
18 – 19	190
20 – 21	80
22 – 23	45

- i. Is the data for the maize appropriate for a histogram or a barchart? Explain your answer. Plot the appropriate plot for these data [4]
- ii. Calculate the mean and standard deviation for the maize data [4]
- 7 An experimenter wished to investigate the relationship between temperature and heartbeat rate in the common grass frog, *Rana Pipens*. The temperature was manipulated in 2 degree Celsius with the heartbeat recorded at each minute. The data are given in the following table:

Temperature (degrees Celsius)	Heartbeat
2	5
4	11
6	11
8	14
10	22
12	23
14	32
16	29
18	32

- (a) Plot the scatter plot of temperature in degrees Celsius against the heart beat per minute [6]
- (b) List any four assumptions of linear regression [4]
- (c) Calculate the regression line for temperature in degrees Celsius against the heartbeat per minute [10]

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