AFRICA UNIVERSITY
(A United Methodist-Related Institution)

"Investing in Africa's Future"

FACULTY OF AGRICULTURE AND NATURAL RESOURCES

2016 FIRST SEMESTER EXAMINATIONS

COURSE CODE: ACP202

COURSE TITLE: BIOMETRY

DATE: November-December 2016

TIME: 3 hours

INSTRUCTIONS

Answer **ALL** Questions in **Section A** and **ANY 3** questions from **Section B**

The mark allocation for each question is indicated at the end of the question

SECTION A

QUESTION 1

Explain the following terms:

i. Variable

ii. Variance

iii. Parameter [6]

QUESTION 2

Given the following data set, 18 44 29 36 39 32 21 48 37 57 37 40 57 23 24 35 32 47 56 41.

i. Calculate the mean, mode, median, standard deviation and coefficient of variation. [10]

Draw the stem and leaf diagram and [5]

ii. Box and whisker plot [10]

QUESTION 3

A box contains 25 apples, of which 20 are red and 5 are green. Of the red apples, 3 contain maggots and of the green 1 contain maggots. Two apples are selected at random from the box. Find the probability that

i. Both apples contain maggots [3]

ii. Both apples are red and at least 1 contains maggots. [5]

iii. At least 1 apple contains maggots, given that both apples are red. [6]

SECTION B

QUESTION 4

a) Define the following terms as used in Agriculture giving appropriate examples

i. Treatment [3]

ii. Factor [3]

iii. Randomisation [3]

iv. Replication [3]

b) Distinguish between the following study designs

i. Randomised Block Design and Completely Randomised Block Design [4]

ii. Split-Plot Design and Split-Split-Plot Design [4]

QUESTION 5

The following dataset represents the leaf spot disease scores on a 1 to 10 scale for a sample of soya bean plants in mixed population of genotypes. On this scale 1= no disease and 10= all leaves diseased with more than 90% defoliation.

16 17 15 17 19 18 16 14 13 17 16 16

Determine the following numerical descriptive statistics

i. Mean [2]

ii. Mode [2]

iii. Median [2]

iv. Variance [6]

v. Standard deviation [2]

vi. Determine the 95% confidence interval for the point estimate of the mean disease score for the soya bean population and interpret it. [6]

QUESTION 6

a) Define the four scales of measurement and give two examples of each. 12]

b) Given that the mean number of piglets born to a pig at AU farm is 10 with a standard deviation of 2. Find the probability that any pig selected from a population of 100 at AU farm will have between 7 and 13 piglets. [$\mu = 10$, $\delta = 2$ and $n = 100$] [8]

QUESTION 7

a). A random sample of 100 Broilers was taken from a population that was given a certain feed and the following 2x2 table was constructed after reviewing the data:

	Coccidiosis		
Feed	Yes	No	Totals
Yes	50	25	75
No	20	5	25
Totals	70	30	100

Determine using a level of significance (α) of 0.05, if the risk of having coccidiosis in the surveyed population of broilers is related to feed. 10] b). A random sample of 10 FANR students was selected to participate in a study to assess physiological changes that occur immediately before and after completing a standardized examination. The following table gives the systolic blood pressure readings for 10 students measured immediately before and after taking a standardized examination. Do these data provide sufficient evidence, at the 0.05 level of significance, to indicate an increase in systolic blood pressure before and after the examination? [10]

	Systolic Blood Pressure	
Subject	Before	After
1	115	128
2	112	115
3	107	106
4	119	128
5	115	122
6	138	145
7	126	132
8	105	109
9	104	102
10	115	117

List of Formulae

$SE_{\bar{X}} = \frac{s}{\sqrt{n}}$ (mean) $\bar{x} = \frac{\sum x}{n}$ $t = \frac{\bar{d} - (\mu_d)}{s_d / \sqrt{n}}$ $s_d = \sqrt{\frac{\sum_{i=1}^{n}(d_i - \bar{d})^2}{n-1}}$

$S^2 = \frac{\Sigma(x - \bar{X})^2}{n-1}$ $S_2{}^2 = \frac{\Sigma(x^2 - \frac{(\Sigma x)^2}{n}}{n-1}$ $t^2 = \frac{\bar{X}-\bar{X}_2}{S_p\sqrt{(1/_n + 1/_{n_2}}}$ $t = \frac{\bar{X}-\mu}{\frac{s}{\sqrt{n}}}$

A 100 (1- α) % confidence interval (CI) for $\mu_1 - \mu_2$ is given by:

$$(\bar{x}_1 - \bar{x}_2) \pm t_{crit} \times \sqrt{\frac{s_p^2}{n_1} + \frac{s_p^2}{n_2}}$$

$$t_{cal} = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{s_p{}^2}{n_1} + \frac{s_p{}^2}{n_2}}} \qquad Z_{cal} = \frac{(\hat{p}_1 - \hat{p}_2) - (p_1 - p_2)}{\sqrt{\bar{p}\bar{q}/_{n_1} + \bar{p}\bar{q}/_{n_2}}},$$

Where: $\bar{p} = \frac{x_1 + x_2}{n_1 + n_2}$ $S^2{}_P = \frac{(n-1)S^2 + (n-1)S_2{}^2}{n + n^2 - 2}$

A 95% confidence interval (CI) for proportion is given by: $p \pm 1.96\sqrt{\frac{p(1-p)}{n}}$

$Z = \frac{\bar{X}-\mu}{\frac{\sigma}{\sqrt{n}}}$ $SE = \sqrt{\frac{s_p^2}{n_1} + \frac{s_p^2}{n_2}}$

$$r = \frac{n\sum xy - \sum x \sum y}{\sqrt{[n(\sum x^2) - (\sum x)^2][n(\sum y^2) - (\sum y)^2]}} \qquad r = \frac{\Sigma(x-\bar{X})(y-\bar{Y})}{\sqrt{[\Sigma(x-\bar{X})^2\Sigma(y-\bar{Y})^2]}}$$

95% CI for a proportion $= p \pm 1.96\sqrt{\frac{p(1-p)}{n}}$ $t = r\frac{\sqrt{(n-2)}}{\sqrt{(1-r^2)}}$

$$b_1 = \frac{\Sigma(x-\bar{x})(y-\bar{y})}{\Sigma(x-\bar{x})^2} \qquad b_1 = \frac{\Sigma xy - \frac{\Sigma x \Sigma y}{n}}{\Sigma x^2 - \frac{(\Sigma x)^2}{n}}$$

$$SE_b = \frac{s}{\sqrt{\Sigma(x-\bar{X})^2}} \quad where\ S^2 = \frac{\Sigma(y-\bar{Y})^2 - b^2\Sigma(x-\bar{X})^2}{n-2}$$

$$b_0 = \overline{Y} - b_1\overline{X} \qquad \chi^2 = \sum\frac{(O-E)^2}{E} \qquad \chi^2 = \sum\frac{(\,|O-E\,|-0.5)^2}{E}$$