

NATIONAL UNIVERSITY OF LESOTHO

FACULTY OF AGRICULTURE

DEPARTMENT OF ANIMAL SCIENCE

B.Sc. AGRICULTURE (ANIMAL SCIENCE)

ANS2506: QUANTITATIVE GENETICS AND ANALYSIS OF TRAITS

SECOND SEMESTER EXAMINATION

JUNE, 2023

MARKS: 100

TIME: 3:00 HOURS

INSTRUCTIONS:

- 1. ANSWER ALL QUESTIONS**
 - 2. YOU ARE ALLOWED TO USE A CALCULATOR**
 - 3. SHOW ALL YOUR WORKING WHERE CALCULATIONS ARE INVOLVED**
 - 4. NUMBER EACH QUESTION APPROPRIATELY**
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Question 1

a) Define the following terms as used in animal breeding and give examples where possible:

- i. Phenotype. [2]
- ii. Locus. [2]
- iii. Terminalization. [2]
- iv. Independent gene effects. [2]
- v. Close population. [2]
- vi. Homolog. [2]
- vii. Single source of information. [2]
- viii. Random environmental effects. [2]
- ix. Recombination. [2]
- x. Collateral relatives. [2]

Question 2

With the following data on weaning weights (kg) and grease fleece weights (kg) simulated for 10 sheep,

Weaning weights (X)	Grease fleece weights (Y)
66.6	2.2
67.5	2.4
54.0	1.7
53.3	1.8
65.2	2.3
62.6	2.8
55.4	1.9
54.1	1.8
57.2	2.0
59.2	2.1
Total 595.1	21.0

calculate the following:

- i. Variance for both traits. [8]
- ii. Covariance. [4]
- iii. Correlation coefficient. [2]
- iv. Regression coefficient of fleece weight on weaning weight. [4]

Question 3

a) Differentiate between the following terms:

- i. Pleiotropic versus linkage. [2]
- ii. Additive value versus non-additive value. [2]
- iii. Polygenic versus simply-inherited. [6]

b) Write short notes on the following:

- i. Mitosis. [4]
- ii. Mendelian inheritance. [6]

c) When breeders receive data on some characteristics, he or she runs some basic statistical analyses to be familiar with the data. In relation to this, briefly explain these basic statistical analyses. [10]

Question 4

a) Describe each element of a selection index equation in statistical terms. [6]

b) Given the following data on feed conversion in a swine population, calculate the rate of genetic change. [9]

Heritability of feed conversion (h^2)	0.35
Phenotypic standard deviation (σ_p)	0.9 kg
Accuracy of male selection ($r_{BV_m, B} \hat{v}_m$)	0.8
Accuracy of female selection ($r_{BV_f, B} \hat{v}_f$)	0.5
Intensity of male selection (i_m)	-2.4
Intensity of female selection (i_f)	-1.5
Generation interval for males (L_m)	1.8 years
Generation interval for females (L_f)	1.8 years

Question 5

a) Define producing ability and clearly outline its significance in animal production. [5]

b) With the following data on records of lengths taken by horses at the finish in their first two races:

Lengths taken		
Horse #	Race # 1	Race # 2
1	0.0	0.0
2	4.5	3.0
3	9.0	10.5
4	4.0	0.0
5	13.0	9.5
6	5.5	7.0

- i. Calculate repeatability for lengths taken from this admittedly smaller sample. [10]
- ii. Is the first race performance a good indicator of the second race performance and why? [2]