CHUKA  **UNIVERSITY**

UNIVERSITY EXAMINATIONS

RESITS/SPECIAL EXAMINATIONS

EXAMINATION FOR THE AWARD OF DEGREE OF BACHELOR OF SCIENCE IN ANIMAL SCIENCE

ANSC 241: QUANTITATIVE GENETICS AND ANIMAL BREEDING

STREAMS: **TIME: 2 HOURS**

DAY/DATE: TUESDAY 29/8/2023 **8.30 A.M. – 10.30 A.M.**

Instructions:

i. This examination has two sections i.e., Section A and Section B. Attempt all questions in Section A and any two questions in Section B
ii. You are allowed to use a calculator
iii. Be clear and show all your working in the Answer Booklet

Section A: Attempt ALL questions. Total marks = 30.

1. Differentiate between the following concepts:
   a. Selection differential and genetic value
   b. Genotype and breeding value
   c. Phenotypic value and trait
   d. Selection index and breeding goal

[12 marks]

2. An animal was recorded to have a phenotypic performance of 200 kg. The heritability, genetic standard deviation and the population mean for the trait were 0.25, 10 kg and 300 kg, respectively.
   a. Calculate the phenotypic standard deviation for the trait

[3 marks]

b. Estimate the breeding value for the animal

[3 marks]

c. Determine the additive genetic relationship between a sire and offspring

[3 marks]

d. Heritability can be defined as the regression of the additive genetic variance on phenotypic variance. Proof.

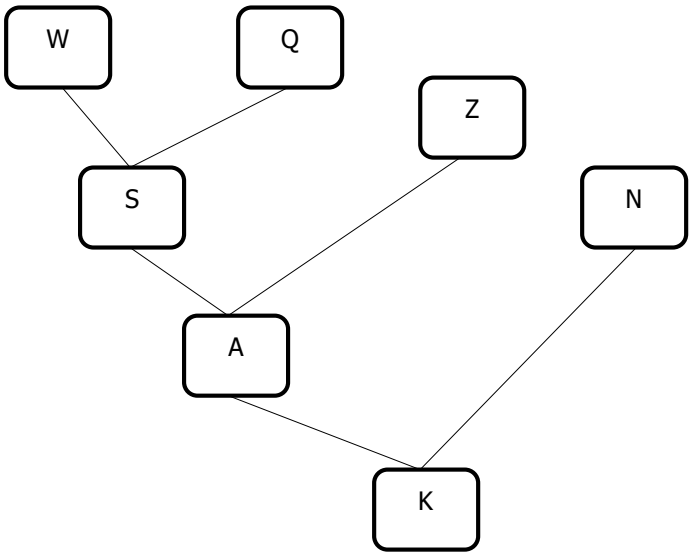
[3 marks]

3. Define the following terms
   a. Inbreeding coefficient
   b. Dominance relationship
   c. Additive genetic relationship
   d. Coefficient of kinship

[9 marks]

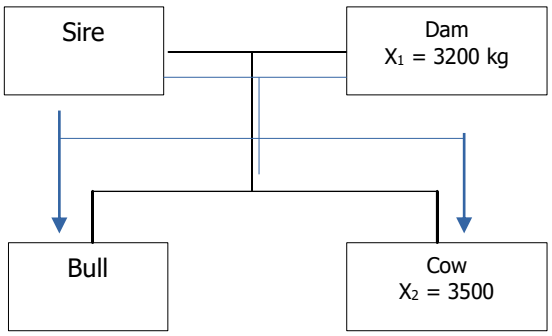
Section B. Attempt any TWO questions. TOTAL marks = 40.

4. Use the method of tracing paths to determine the genetic relationships between K and W, K and Z, A and Q, A and W, Z and W, A and N, N and W, S and Q, W and S, and Z and S, in the pedigree provided below.



[20 marks]

5. Given the pedigree below, write out the selection index, I, for the bull and use all the available information to estimate the bull's breeding value.



Additional information: σ^2_P = 300,000 kg^2; μ = 3,300 kg; h^2 = 0.30

[20 marks]

6. A locus B has two alleles B_1 and B_2. The genotypic values for are B_2B_2, B_1B_2 and B_1B_1 are 200 kg, 220 kg and 230 kg, respectively. The frequency of B_1 allele, p, is equal to 0.75.
    a. Determine the average gene substitution effect for this locus [6 marks]
    b. Estimate breeding values for B_1B_1, B_1B_2 and B_2B_2 genotypes [9 marks]
    c. Calculate the genotypic mean for this locus [5 marks]

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