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University Examinations 2024/2025

SECOND YEAR FIRST TRIMESTER EXAMINATION FOR THE DEGREE OF BACHELLOR OF SCIENCE IN ANIMAL HEALTH AND PRODUCTION

AAP 3254: QUANTITATIVE GENETICS AND ANIMAL BREEDING

DATE: JANUARY 2025

TIME: 2 HOURS

INSTRUCTIONS:

- i. Answer question **ONE** and any other **TWO** questions
- ii. Every question has marks indicated
- iii. Some useful formulae are provided

QUESTION ONE (30 MARKS)

- i. Name two tools used for genetic improvement (4 Marks)
- ii. Illustrate sources of pedigree records where traits for economic importance for sire evaluation is majority based on (6 Marks)
- iii. Define the term "inbreeding" as used in animal breeding and state any three possible consequences for using it as a breeding tool. (4 Marks)
- iv. Give FOUR factors that affect gene and genotypic frequencies in a population (4 Marks)
- v. Differentiate between dominance deviation and epistatic effects (4 Marks)
- vi. Outline traits that can be repeatedly measured (4 Marks)
- vii. Differentiate between the following terms: (4 Marks)
 - i. Continuous variables
 - ii. Discrete values

QUESTION TWO (20 MARKS)

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Consider a population of 1000 animals, AA individuals=150, Aa =100 and aa =750 for which we want to calculate the allele frequencies for a single locus that shows incomplete dominance. Because there is incomplete dominance, we can distinguish the heterozygote from both homozygotes.

- a) Calculate the genotypic frequencies (6 Marks)
- b) Calculate the allele frequencies (4 Marks)
- c) Show whether this population is in Hardy-Weinberg equilibrium (6 Marks)
- d) Differentiate between genetic value and breeding value (4 Marks)

QUESTION THREE (20 MARKS)

- a) Discuss the process a biotechnologist will employ to disseminate the germplasm of a good dairy cow as fast as possible (6 Marks)
- b) Explain why Artificial Insemination is less developed in developing countries (4 Marks)
- c) Suppose that the weight of Sows is determined by single locus with two alleles and that their genotypic values are 130 kg for bb, 150kgs for Bb and 160kg for BB. Assume $p=0.3$ and $q=0.7$
 - i. Calculate the population mean (m) (4 Marks)
 - ii. Calculate the total genetic variance (VG) (6 Marks)

QUESTION FOUR (20 MARKS)

- a) Illustrate Six traits of economic importance for a dairy animal (6 Marks)
- b) Suppose that you are tasked by a breeding company to increase longevity in beef cattle by means of selection. Average herd life in beef cattle equals 1670 days with a phenotypic standard deviation of 300 days. After ranking beef cattle on herd-life, then you consider three alternatives for the selected proportion: 1. the 50% highest ranking cows 2. the 25% highest cows and 3. the 5% highest cows. Given; $p_{50\%} i = 0.798$; $i = 2.061$
 - i. What is the selection intensity and the selection differential for each alternative? (7 Marks)
 - ii. What would be the absolute phenotypic values for herd-life of the selected parents (3 Marks)
 - iii. What is the response to selecting 25% cows over random bulls? (3 Marks)
 - iv. What general comment would you deduce from the trend observed in b a above? (1 Mark)