

THE UNIVERSITY OF NEW ENGLAND
EXAMINER INFORMATION FORM

UNIT NAME : **GEST 325**

PAPER TITLE: **Quantitative Genetics and Statistics**

PAPER NUMBER: _____

TIME ALLOWED: **2 (two) hours**

**IS THIS PAPER TO BE WITHHELD FROM THE CANDIDATES AND
LIBRARY REFERENCE AFTER THE EXAMINATION ?**

YES

NUMBER OF PAGES IN PAPER: **4 (FOUR)**

NUMBER OF QUESTIONS ON PAPER: **17 (seventeen)**

NUMBER OF QUESTIONS TO BE ANSWERED: **17 (seventeen)**

Pocket calculators permitted : **YES** (Silent type)

Mathematical tables permitted: **NO**

Other aids required: **NIL**

TEXTBOOKS OR NOTES PERMITTED: **NO**

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SECTION A

30 marks

For each of the following questions write in your answer book the single letter corresponding to the answer that is most correct. Each question is worth 3 marks. Answer all questions.

- 1 Which of the following depends on the population's gene frequencies?
 - A. The average effect of gene substitution
 - B. The phenotypic value of a specified genotype
 - C. The breeding value of a specified genotype
 - D. A and C above.

- 2 Which of the following is **not** correct? The concept of selection intensity can be used to help:
 - A. Predict responses to selection
 - B. Predict selection differentials
 - C. Predict the proportion of selection superiority that is given to offspring
 - D. Predict superiority of parents.

- 3 Two animals A and B are of the same age and have the same weight at weaning but they have different EBVs for growth: Animal A's EBV is higher. This can be explained by the fact that possibly
 - A. Animal A was born as a single whereas animal B was born as a twin and singles are generally heavier than twins.
 - B. Animal A has a mother with a better maternal effect
 - C. Animal B has a father with a very high EBV
 - D. Animal B was born as a single whereas animal A was born as a twin.

- 4 Genetic markers are mostly useful to assist in selection for traits that
 - A: have a high heritability
 - B: are expressed late in an animal's life
 - C: are not influenced by environmental effects
 - D: can only be measured in young animals

- 5 It is useful to know the repeatability of trait measurement as it provides information about
 - A. whether or not it is useful to select based on repeated measurements
 - B. whether or not the trait is heritable at all
 - C. selection for that trait will be successful
 - D. both B and C

6. Which of the following describes selection criteria?
- A. The overall aim of the selection program
 - B. The information used to make selection decisions
 - C. The genetic parameters involved in the selection program
 - D. None of these.
7. Maternal heterosis effects can be estimated in breeding systems where
- A. Purebred mothers are crossed with purebred sires from another breed.
 - B. Purebred mothers are mated with crossbred sires
 - C. Crossbred mothers are used
 - D. Both sire and dams need to be crossbred
8. Which of the following describes the generation interval in a population?
- A. The average time between successive selection rounds
 - B. The average age of female parents when their progeny are born
 - C. The average of both male and female parents
 - D. The sum of the average age of male and female parents.
9. Progeny testing can be more valuable than selection based on individual performance mass selection because:
- A. Selection intensity can be increased
 - B. Generation interval can be increased
 - C. Accuracy of estimating breeding values can be increased
 - D. B and C above.
10. The relative economic value of a trait in the breeding objective depends on
- A. The extent to which differences for this trait determine profit
 - B. Whether the traits can be measured or not.
 - C. The heritability of the trait
 - D. The price of a breeding animal.

SECTION B

40 marks

Each question is worth as indicated. Answer all four questions.

B - 1. [10 marks]

In a herd of beef cattle under selection for yearling weight, the superiority of selected bulls is 40 kilograms and the superiority of selected heifers is 20 kilograms. What is the response to selection per generation expected to be if heritability is 30 percent?

If the average age of bulls when their progeny are dropped is 3 years, and the average age of cows when their progeny are dropped is 6 years, what is the predicted response to selection per year?

B-2: A dairy bull sires 20 daughters who perform on average better than their contemporaries by 500 kilograms first lactation milk yield. What is the expected superiority over these contemporaries of any future daughters he sires if the heritability of milk yield is 0.25? What is the estimated breeding value of this bull?

Recall that the heritability of a progeny test is: $\frac{n}{n+a}$ where $a = \frac{4-h^2}{h^2}$

B-3 [10 marks]

The age structure for a flock of sheep is shown below. Ages are given in years.

The number of lambs weaned per breeding females is equal to 0.8.

Assume the breeder practices progeny selection.

Age when progeny are dropped:	2	3	4	5	6	Total
Number of rams :	15	10				25
Number of ewes:	250	200	150	100	50	750

- a) Find the overall generation interval.
- b) What are the selected proportions for males and females?
- c) Explain how an increase in weaning rate would increase the rate of response to selection.

B-4 [10 marks]

Postweaning gain in cattle has been found to be essentially unaffected by maternal effects. Given this, predict the postweaning gain of animals in a 2 breed rotational cross (at equilibrium and averaged over years) derived from two breed rotation of breeds A and B. Use the results in the following table as a source of data. State any assumptions which you make.

GENOTYPE	POSTWEANING GAIN, grams/day
Breed A	900
Breed B	1200
A x B	1190

SECTION C

30 marks

Answer all questions, marks are as shown.

1. [10 marks] Give a numerical example to illustrate how the use of a reference sire can lead to an estimate of the genetic difference between flocks for a measured trait such as fleece weight.
2. [10 marks] Use a diagram to illustrate why open nucleus breeding schemes are expected to give faster rates of genetic gain than closed nucleus breeding schemes.
3. [10 marks] Describe the value of using a selection index, including reference to the following:
 - i. Formulating an objective incorporating more than one trait.
 - ii. Information from relatives.
 - iii. The difference between objectives and criteria.