



MACHAKOS UNIVERSITY

University Examinations for 2021/2022 Academic Year

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF BIOLOGICAL SCIENCES

SECOND YEAR SECOND SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE IN AGRICULTURAL EDUCATION AND EXTENSION

ANS 241: QUANTITATIVE GENETICS AND BREEDING

DATE: 26/5/2022

TIME: 8.30-10.30 AM

INSTRUCTIONS

There are two sections A and B. Answer all the question in section A and only TWO (2) in section B

Section A: Answer all the questions

QUESTION ONE (COMPULSORY) (30 MARKS)

- a) A population has the following genotypes and the number of individuals: $A_1A_1=40$ individuals, $A_1A_2 = 20$ individuals, $A_2A_2=140$ individuals.
Calculate the observed frequency for each genotype if the population has two (2) codominant markers/genes (3 marks)
- b) Explain selfing as a breeding system (3 marks)
- c) Describe phenotype with emphasis to population and environment (3 marks)
- d) Distinguish between gene and allele (3 marks)
- e) Describe polymorphism at quantitative molecular level (3 marks)
- f) Outline three key genetic features of a structured population (3 marks)
- g) Describe three types of nonrandom mating in breeding (3 marks)
- h) Outline three conditions under which effective population would be less than the total population (3 marks)
- i) Outline the limitations of the single marker analysis in QTL mapping (3 marks)
- j) Calculate the allelic loss in a population undergoing bottleneck and founder effects when $N = 15$, $p = 0.90$ and $q = 0.1$, (3 marks)

SECTION B: ANSWER ONLY TWO (2) QUESTIONS

QUESTION TWO (20 MARKS)

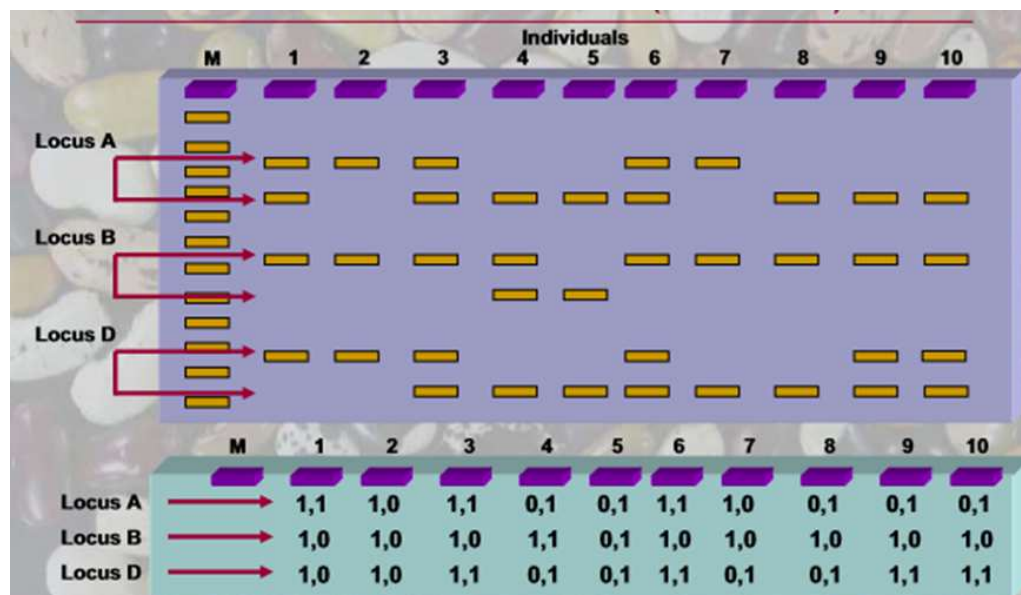
Study the table below which is a result of quantitative observations of individuals with the following genotypes AA, Aa and aa.

Genotype	AA	Aa	aa	Total X^2 value (Chi-square value)
No of observed individuals	169	520	311	
No of Expected individuals	250	500	250	
X^2 value (chi-square Value)	+25.921	+0.760	+14.641	41.322

Assuming that the quantitative allelic frequencies in this population are 0.429 for A_1 and 0.571 for A_2 and that the level of freedom is 1. Test whether this population is in Hardy Weinburg equilibrium.

QUESTION THREE (20 MARKS)

Study the photo of the gel below showing the observation of genotypes with individual with codominant markers.



Calculate

- The genotype frequencies. (10 marks)
- Allelic frequencies. (10 marks)

QUESTION FOUR (20 MARKS)

- Discuss forces shaping genetic diversity in a population. (10 marks)
- Discuss the history of linkage mapping using two mapping functions. (10 marks)

QUESTION FIVE (20 MARKS)

Discuss Simple Interval Mapping (SIM) in quantitative Trait Loci mapping.