



1st SEMESTER 2011/2012
UNIVERSITY OF SWAZILAND
FINAL EXAMINATION PAPER

PROGRAMMES: BSc ANIMAL SCIENCE II
BSc. ANIMAL SCIENCE (DAIRY OPTION) II
BSc AGRONOMY II
BSc HORTICULTURE II
BSc AGRICULTURAL EDUCATION II

COURSE CODE: AS 204

TITLE OF PAPER: PRINCIPLES OF GENETICS

TIME ALLOWED: TWO (2) HOURS

INSTRUCTIONS: ANSWER ANY 4 QUESTIONS

THIS PAPER MAY NOT BE OPENED UNTIL THE CHIEF INVIGILATOR HAS GRANTED PERMISSION

1. (a) Define the following genetic terms:
 - i). Codominance (4)
 - ii). Pangenesis (4)
 - iii). Locus (3)
 - iv). Hemizygous (3)

(b) Which gametes are going to show more variation, those arising from a meiotic process or those from a mitotic process? Explain why this is the case (6)

(c) Name and fully state Mendel's first law (5)
2. (a) Discuss each of the following:
 - i). Meiotic crossover (6)
 - ii). Sex linked inheritance (10)

(b) If there is a single nondisjunction event during meiosis I comment on the type of gametes that are expected on completion of meiosis II? Use a cell with $2n=2$ and a diagram to illustrate your answer (9)
3.
 - a) Sketch the symbols used to represent the following situations in a pedigree: (Copy and complete the table in your answer book) (6)

Situation	Symbol in a pedigree
Consanguinity	
Affected, sex unknown	
Asymptomatic carrier	

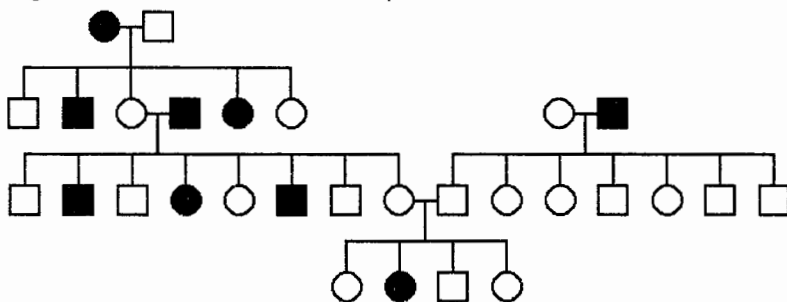
b) In the Sangria indigenous chicken, frizzled feathering pattern (F) is dominant to normal feathering, black plumage (B) is dominant to brown and single comb (S) is dominant to double comb. A true breeding frizzle feathered chicken with black plumage and a single comb is bred by cock that has a normal feathering pattern, brown plumage and a double comb to produce F1 progeny. The F1 progeny are test crossed and the following progeny are observed:

Phenotype of test cross progeny	Observations
Frizzled, brown and single comb	490
Normal, brown and single comb	112
Frizzled, black and single comb	130
Normal, black and single comb	0
Frizzled, black and double comb	140
Normal, brown and double comb	138
Normal, black and double comb	386
Frizzled, brown and double comb	2

- i) How are the genes arranged on the chromosomes? (2)
- ii) Which gene is in the middle? (2)
- iii) Calculate the genetic distances and draw the three point linkage map. (10)
- iv) Determine the number of double crossover progeny that were expected? (2)
- v) Give a possible explanation for the small number of observed double crossovers compared to what was expected? (3)

4.

Study the diagram below and answer the questions below it.



- i. What do we call this type of diagram? (1)
- ii. Is there a consanguineous marriage in this pedigree? (2)
- iii. State the mode of inheritance? (3) List one reason to justify your answer. (1)
- iv. What is the probability that II.1 is not a carrier? (2)
- v. What is the probability that III.9 is a carrier? (2)
- vi. What is the probability that III.5 is a carrier? (2)
- vii. If III.3 married III.10 what is the probability that their first baby could be affected? (3)
- viii. What is the probability that a fifth baby from III.8 and III.9 will be a carrier (2)
- ix. From this pedigree, list three individuals who could possibly be homozygous dominant. (3)
- x. Copy the table below into your answer book. Use the pedigree diagram to complete the table. (4)

Identity of individual	Most likely genotype
II.3	
III.8	

- 5. (a) List three advantages of three point linkage mapping over two point linkage mapping? (4)
- (b) Apart from luck, list three reasons why Mendel succeeded where many biologists had failed? (6)
- (d) State Mendel's second law and a deviation from this law (5)
- (e) In pea plants the gene for tall plants is dominant to the gene for short plant. At another locus the gene for smooth seed is dominant to the one for wrinkled seed. You are presented with a tall plant that produces smooth seed. Give a step by step explanation of what you would do to determine the genotype of this pea plant. (10)