MAASAI MARA UNIVERSITY

REGULAR UNIVERSITY EXAMINATIONS
2017/2018 ACADEMIC YEAR

SCHOOL OF SCIENCE & INFORMATION SCIENCE
FOURTH YEAR SECOND SEMESTER
BACHELOR OF SCIENCE (BOTANY)

COURSE CODE: BOT 418
COURSE TITLE: POPULATION GENETICS

DATE: 24TH APRIL, 2018   **TIME: 1100 – 1300HRS**

INSTRUCTIONS TO CANDIDATES

- Answer **All** questions in **Section A** and **ANY TWO** in **Section B**
- Illustrate your answers with suitable diagrams wherever necessary

This paper consists of 3 printed pages. Please turn over.

SECTION A: answer ALL questions (30 marks)

1) Distinguish between the following terms: **(3 marks)**
   a. Random and assortative mating
   b. Transient polymorphism and balanced polymorphism
   c. Heterosis and Heterozygote advantage

2) Calculate the allele frequencies from the following population data set**.** **(3marks)**

Genotype	Number
AA	68
Aa	42
aa	24
TOTAL	134

If the fitness value for the three genotypes is 1.0, 0.8 and 0.2 respectively. Calculate new allelic frequencies after one generation of directional selection. **(3marks)**

3) In a large herd of cattle, three different characters showing continuous distribution are measured and the variance in the table calculated.

VARIANCE	CHARACTERS		
	SHANK LENGTH	NECK LENGTH	FAT CONTENT
V_P	310.2	730.4	106.0
V_E	248.1	292.2	53.0
V_A	46.5	73.0	42.4
V_D	15.6	365.2	10.6

Calculate the broad sense and narrow sense heritability for each character. **(3 marks)**

4) Explain **THREE** disadvantages of inbreeding. **(3 marks)**

5) State modern reasons that lead to the loss of wild population and subsequent loss of alleles **(3 marks)**

6) In a large herd of **5,468** sheep, **76** animals have yellow fat, compared to the rest of the members of the herd, which have white fat. Yellow fat is inherited as a recessive trait.
   a) Calculate the frequencies of the white and yellow fat alleles in this population. **(1.5 marks)**
   b) Approximately how many sheep with white fat are heterozygous carriers of the yellow allele? **(1.5 marks)**

7) Explain why elimination of a fully recessive deleterious allele by natural selection is difficult. **(3 marks)**

8) Calculate the equilibrium frequency of a lethal recessive allele if its rate of forward mutation is 10^{-5} and its selection coefficient is 0.1. **(3 marks)**

9) Describe briefly stabilizing selection. **(3marks)**

SECTION B: answer ANY TWO questions (40 marks)

10) Insecticides are commonly used to compact many insect pests. During the past several decades, however, insecticide resistant strains of insects have become alarmingly prevalent. This has undermined the ability of farmers to control many insects. Discuss how the following processes that alter allele frequencies may have contributed to the emergence of insecticide-resistant strains:

   a) Random mutation. **(4marks)**
   b) Genetic drift. **(3marks)**
   c) Gene flow. **(6marks)**
   d) Natural selection. **(7marks)**

11) Discuss barriers to random mating. **(20 marks)**

12) With examples, discuss genetic drift as a factor that leads to changes in allelic frequency. **(20marks)**

13) The gene for coat color in rabbits can exist in four alleles **C** (full coat color), **c^{ch}** (chinchilla), **c^h** (Himalayan), and **c** (albino). In a population of rabbits the allele frequencies are: **C=0.34**, **c^{ch}=0.17**, **c^h=0.44** and **c=0.05.** Assume that C is dominant to the other three alleles. c^{ch} is dominant over c^h and c, and c^h is dominant over c.

    a. Calculate the frequency of albino rabbits.

    b. Among 1,000 rabbits how many would you expect to have a Himalayan coat color?

    c. Among 1,000 rabbits how many heterozygote would you expect to have a chinchilla coat color?

    d. If in the next generation the following is observed test whether the population is in Hardy-Weinberg equilibrium (HWE).

PHENOYPE	NUMBER
FULL COLOR	835
CHINCHILLA	299
HIMALAYAN	360
ALBINO	6
TOTAL	1500

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