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Maasai Mara University

UNIVERSITY EXAMINATIONS 2016/2017

**FOURTH YEAR SECOND SEMESTER EXAMINATIONS**

**FOR**

**THE DEGREE OF BACHELOR OF SCIENCE (BOTANY)**

BOT 418: POPULATION GENETICS

**DATE: 10th May 2017 TIME: 0830-1030**

**INSTRUCTIONS TO CANDIDATES**

Answer **All** questions in **Section A** and **ANY TWO** in **Section B**

Illustrate your answers with suitable diagrams wherever necessary

**SECTION A: answer ALL questions (30 marks)**

1. Distinguish between the following terms: **(3 marks)**
2. Co-efficient of Inbreeding and inbreeding depression
3. Mendelian and local population
4. Founders effect and bottle neck effect
5. 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)**

1. In an experimental population of *Tribolium* (flour beetle), the body length shows a continual distribution with a mean of **6mm**. A group of males and females with body lengths of **9mm** are removed and interbred. The body lengths of their offspring average **7.2mm**. From these data, calculate the narrow sense heritability for body length in this population. **(3 marks)**
2. Explain **THREE** advantages of inbreeding. **(3 marks)**
3. Describe briefly named evolutionary forces which act to increase, or slow down, respectively, the rates of genetic differentiation between populations. **(3 marks)**
4. 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.
5. Calculate the frequencies of the white and yellow fat alleles in this population. **(1.5 marks)**
6. Approximately how many sheep with white fat are heterozygous carriers of the yellow allele? **(1.5 marks)**
7. Briefly discuss genetic factors affecting the phenotypic variance.

**(3 marks)**

1. 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)**
2. Describe gene flow as a factor that alters genetic equilibrium.**(3marks)**

**SECTION B: answer ANY TWO questions (40 marks)**

1. Antibiotics are commonly used to compact bacterial and fungal infections. During the past several decades, however, antibiotics resistant strains of microorganisms have become alarmingly prevalent. This has undermined the ability of physicians to treat many types of infectious diseases. Discuss how the following processes that alter allele frequencies may have contributed to the emergence of antibiotic-resistant strains:
2. Random mutation. **(4marks)**
3. Genetic drift. **(3marks)**
4. Gene flow. **(6marks)**
5. Natural selection. **(7marks)**
6. Discuss barriers to random mating.**(20 marks)**
7. The gene for coat color in rabbits can exist in four alleles **C** (full coat color), **cch** (chinchilla), **ch** (Himalayan), and **c** (albino). In a population of rabbits the allele frequencies are: **C=0.34**, **cch=0.17**, **ch=0.44** and **c=0.05.** Assume that C is dominant to the other three alleles. cch is dominant over ch and c, and ch is dominant over c.
8. Calculate the frequency of albino rabbits.
9. Among 1,000 rabbits how many would you expect to have a Himalayan coat color?
10. Among 1,000 rabbits how many heterozygote would you expect to have a chinchilla coat color?
11. 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 |