MAASAI MARA UNIVERSITY

REGULAR UNIVERSITY EXAMINATIONS
2019/2020 ACADEMIC YEAR
FOURTH YEAR FIRST SEMESTER EXAMINATIONS
FOR
BACHELOR OF SCIENCE (BOTANY) AND BACHELOR OF SCIENCE (ZOOLOGY)

COURSE CODE: BOT 4120
COURSE TITLE: POPULATION GENETICS

DATE: 4TH DECEMBER, 2019 **TIME: 1100-1300HRS**

INSTRUCTIONS TO CANDIDATES

Answer **ALL** questions in Section A and any other **TWO** questions in **Section B**.

SECTION A: ANSWER **ALL** QUESTIONS (30MARKS)

1. Define the following terms as used in Genetics: **(3marks)**
a. gene pool
b. local population
c. mutation rate

2. List three factors that govern microevolution **(3marks**)

3. Distinguish the following terms as used in population genetics **(3marks)**

a. Allele frequency and genotype frequency

b. Inbreeding and outbreeding

c. polymorphism and single nucleotide polymorphism

4. With one example describe horizontal gene transfers **(3marks)**

5. State any three conditions of Hardy-Weinberg equation equilibrium **(3marks)**

6. Name any three types of mutation that provide source of genetic variation **(3marks)**

7. Explain multiple allelic inheritance and its significance **(3marks)**

8. The M-N blood groups in man is determined by two alleles at a locus, and the three genotypes correspond with the three blood groups. The following table gives the blood group frequencies in a population. Calculate gene/allele and genotypic frequencies in this population. **(3 marks)**

Genotype	MM	MN	NN	Total
Population	475	89	5	569

9. Giving one examples of each distinguish between a random and an adaptive evolutionary process? Describe one examples of each. At molecular level, explain how mutation can random or adaptive **(3marks)**

10. With an example, describe how genetic drift influences change in population via bottleneck effect. **(3marks)**

SECTION B: ANSWER ANY OTHER **TWO** QUESTIONS (40 MARKS)

11. Describe sources of new genetic variation that occurs in population

(20marks)

12. Read the information provided in question 12a and 12b, and use the information to answer the information to answer the question that follow

(a) The Hardy-Weinberg equation provides genotype based on allele frequency. In the case of mammals males are hemizygous for X-linked genes, whereas female have two copies. Among males, the frequency of any X-linked traits will equal the frequency of males with the trait. For example, if an allele frequency for an X –linked diseases causing allele was 5% then 5% of all male would be affected with the disorder. Female genotype frequencies are computed using the Hardy-Weinberg equation.

Let us consider the human X-linked trait known as hemophilia A. In human population the allele frequency of the hemophilia A allele is approximately 1 in 10,000 or 0.0001. The other allele for this gene is the normal allele. Males can be affected or un affected, whereas, females can be affected, unaffected carriers or unaffected non carriers

I. What are the allele frequencies for the mutant and normal allele in the human population? **(2marks)**
II. Among male, what is the frequency of affected individuals? **(2marks)**
III. Among female, what is the frequency of affected individuals **(2marks)**
IV. Within a population of 100,000 people, what is the expected number of affected male? In the same population, what is the expected number of carrier female **(4marks)**

(b.) The pigmentation in a species of insect is controlled by single gene existing in two allele, D for dark and d for light. The heterozygous Dd is intermediate in color. In heterogeneous environment, the allele frequencies are D =0.7 and d=0.3. This polymorphism is maintained because the environment contains some dimly lit forested area and some sunny fields. During a hurricane, a group of 1,000 insect is blown to a complete sunny area. In this experiment, the fitness values are DD=0.3, Dd=0.7, and dd=1.0. Calculate the allele frequencies in the next generation **(8marks)**

11. With examples, distinguish between repressible and inducible regulatory mechanisms in *E. coli* **(20 marks)**

12. Discuss the application and protocol of DNA finger printing **(20marks)**

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