



SOUTH EASTERN KENYA UNIVERSITY

UNIVERSITY EXAMINATIONS 2016/2017

FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF OF SCIENCE IN BIOLOGY

SBL404: POPULATION GENETICS

13TH DECEMBER, 2016

TIME:1.30-3.30 P.M

INSTRUCTIONS TO CANDIDATES

(a) Answer ALL the Questions in Section A

(b) Answer ANY TWO Questions in Section B

(c) Illustrate your answers with well labeled diagrams where appropriate

SECTION A (30 Marks)

1. List three major assumptions of Hard Weinberg Equilibrium. **(3 marks)**
2. In a stable population, if allele A has a frequency of 0.65 and the frequency of allele a is 0.35. Calculate the genotypic frequencies of the:
 - a) homozygote dominant individuals. **(1 mark)**
 - b) homozygous recessive individuals. **(1 mark)**
 - c) heterozygote individuals. **(1 mark)**
3. Giving an example for each case, differentiate between mutation and polymorphism. **(3 marks)**
4. Differentiate between a wild type and a dominant allele. **(2 marks)**
5. State three sources of genetic variation. **(3 marks)**
6. Give three causes of population genetic differentiation. **(3 marks)**
7. Briefly discuss the main effects of outbreeding in natural populations. **(3 marks)**

- 8 A population of mice commonly found at the SEKU garden exhibits two colour morphs, white and brown. As part of his fourth year project, a SEKU student crossed two white coloured mice. All the F1 offspring exhibited the white-colour morphotype. When two brown-coloured mice were crossed, most of the F1 offspring exhibited the brown-colouration but some exhibited the white-coloured phenotype. Briefly explain the most likely explanation for these results. **(3 marks)**
- 9 Give three advantages of DNA molecular markers. **(3 marks)**
- 10 a) Sickle cell anaemia is a hereditary hemoglobin defect caused by a recessive allele HbS. Individuals who are heterozygous and produce both HbA and HbS hemoglobin have been shown to be usually healthy with a small fraction suffering some symptoms of sickle-cell anaemia when under extended reduction of blood oxygen levels. Why is this so? **(2 marks)**
- b. Various studies have shown that carriers of sickle cell anaemia are likely to survive in Malaria-prone areas as compared to the normal and recessive phenotypes. Explain. **(2 marks)**

SECTION B (40 Marks)

- 11 The genetic composition of a population at any given time is a product of the various evolutionary processes acting independently or jointly. Explain how each of the following scenarios would affect the genepool of a population:
- a) An abrupt drought that causes mass deaths of individuals in a population. **(4 marks)**
 - b) Mating involving members of the same genetic lineage. **(4 marks)**
 - c) Human-mediated translocation of animals from one national park to another. **(4 marks)**
 - d) Selection favouring a single phenotype. **(4 marks)**
 - e) Unequal fitness among the members of a breeding population. **(4 marks)**
- 12 Discuss the applications of population genetics in animal science **(20 marks)**
- 13 Discuss the attributes that make mitochondrial DNA an ideal genetic marker for population genetic studies. **(20 marks)**
14. In a study of the Digo tribe in the Mombasa County, a researcher found 26 albino individuals in a total population of 6000. This form of albinism is controlled by a single gene with two alleles: albinism is recessive to normal skin coloration. From the information provided above:

- a) Why can't one calculate the actual allele frequencies in the population? **(2 marks)**
- b) Calculate the expected allele frequencies and genotype frequencies if the population were in Hardy-Weinberg equilibrium. **(10 marks)**
- c) How many of the Digo are estimated to be homozygous normal and carriers of the recessive albino allele? **(4 marks)**
- d) How would one decrease the proportion of albinism in this population in the future generations? **(2 mark)**. Substantiate your answer. **(2 marks)**