COLUMBIA UNIVERSITY

DEPARTMENT OF BIOSTATISTICS

P 8149 - HUMAN POPULATION GENETICS

exercise sheet 1 (covers chapters 1 and 2)

Date due: Monday Sep 29, 2025

Question 1

Three allelic variants, A, B, and C of the red cell acid phosphatase enzyme were found in a sample of 178 people. All genotypes were found in a sample of 178 English people. All genotypes were distinguishable by electrophoresis, and the frequencies in the sample were:

genotype	AA	AB	BB	AC	BC	CC
frequency (%)	9.6	48.3	34.3	2.8	5.0	0.0

What are the gene frequencies in the sample?

Question 2

What will be the genotypic composition of the next generation under the random system of mating if the initial genotypic composition is $(P_{11}, P_{12}, P_{22}) = (.2,.4,.4)$?

Question 3

About 30% of people do not recognize the bitter taste of phenyl-thiocarbamate (PTC). Inability to taste is due to a single autosomal recessive gene. What is the frequency of the non-tasting gene, assuming the population to be in Hardy-Weinberg equilibrium (HWE)?

Question 4

Albinism occurs with a frequency of about 1 in 20000 in European populations. Assuming it to be due to a single autosomal recessive gene, and assuming the population to be in HWE, what is the approximate proportion of people who are carriers?

Question 5

The following numbers are the numbers of the human M-N blood groups were recorded in a sample of American whites:

M	MN	N
1787	3039	1303

(a) What genotype frequencies are observed in the sample?
(b) What are the gene frequencies?
(c) Test whether the genotypes are in HWE.

Question 6

A certain population is triploid. A particular locus has two alleles A_1 and A_2 with frequencies p and $q = 1- p$ respectively. Calculate its genotypic composition under one generation of random mating (assume all conditions underlying the HWE).

Hint: Use a binomial expansion or an argument based on the random union of gametes.

ANSWERS

Q1: freq(A) =.3515, freq(B)=.6095, freq(C)=.039, Q2: Same as before, Q3: .55, Q4: .014, Q5: (a) MM: 29.16%, MN: 49.58%, NN: 21.26%; (b) M: 53.95%, N: 46.05%; (c) X^2_{test} = .027, p-val = .869, do not reject H_0: HWE

Dr. P Gorroochurn: Sep 19, 2025