



NTNU – Trondheim
Norwegian University of
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Department of Biology

Examination paper for BI3010 – Population Genetics

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Permitted examination support material: Calculators Citizen SR-270X,
SR-270X College, and HP30S.

Other information:

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Checked by:

Date

Signature

The questions are weighted differently

Question 1. (Weight 4)

Define/explain the following topics (a-i):

- Population
- Metapopulation
- Panmictic population
- Genetic polymorphism
- Gene flow
- (Random) genetic drift
- Natural selection
- Genetically effective population size (N_e)
- Observed (H_O) and Expected (H_E) heterozygosity

Question 2 (weight 1)

Assume a local panmictic population which usually counts $N_e = 500$ individuals. At a polymorphic locus with alleles A and B the frequency of allele $A=0.60$. In a specific generation the population receives a number of immigrants with frequency of $A=0.10$, and these individuals make up 40% of all the locally reproducing individuals this generation. Assume that the reproduction is panmictic and that generations are non-overlapping.

- Calculate the expected frequency of allele A in the next generation
- Is the next generation expected to be in Hardy-Weinberg equilibrium at the actual locus? Explain your answer.

Question3. (Weight 3)

- What is “Linkage Disequilibrium”, abbreviated “LD” (and also called “Gametic phase disequilibrium”)?
- Mention possible reasons for LD.
- Assume two loci A and B , each with 2 alleles: A_1 and A_2 and B_1 and B_2 , respectively. The frequencies of gametes and alleles are listed in the table below. Calculate D and D' .

Gamete	Frequency	Allele	Frequency
A_1B_1	0,70	A_1	0,75
A_1B_2	0,05	A_2	0,25
A_2B_1	0,10	B_1	0,80
A_2B_2	0,15	B_2	0,20

Question 4. (weight 1)

In an experiment set up to estimate the heritability (h^2) of body length at age = 2 years in alligators, the average length at age 2 in the start population was 100cm. A sub-group with a mean length of 120cm was used to produce the next generation, which showed a mean body length of 108cm at age 2 years. What was the heritability of the trait under selection?

Question 5. (Weight 2)

- a) Describe the common understanding of the concept “molecular clock” and how this phenomenon has been explained traditionally.
- b) Give an account for the most important critic against the use of molecular clocks.

Question 6. (Weight 3)

- a) What is the purpose of substitution models?
- b) Give a brief account for how the Jukes-Cantor model is developed.