

MATH 338: Discrete and Probabilistic Methods in Biology

Quiz 1

NAME: _____

Date: February 14, 2019

Answer the following questions on this sheet of paper. No calculators or other electronic devices are permitted.

1. (5 points) The ABO blood type is inherited from both parents via the ABO gene (on chromosome 9, an *autosomal* chromosome). The three possible alleles are A,B, and O. A and B are *codominant* (meaning type AB is distinct from types A or B) over the recessive allele O.
 - (a) What are the possible genotypes related to blood type?
 - (b) For each genotype, list the corresponding blood types (i.e. phenotypes).
 - (c) What are the possible blood types of offspring of parents with blood type (e.g. phenotype) A?

2. (5 points) Prior to Mendel, *blending* was a popular (and intuitive!) theory of heredity. Specifically, a trait of an offspring would be the average of the values of traits of its parents. To quantify, suppose that X denotes the random variable of a trait value (e.g. height) with variance σ^2 . In random mating, your parents have values X_1 and X_2 for the considered trait, where X_1 and X_2 are independent and identically distributed as X .
 - (a) Under the given hypothesis of blending, what is the value for the trait of the offspring?
 - (b) What is the variance of the trait in the offspring population?
 - (c) Describe, in words, what happens to the variance in subsequent generations (i.e. what are the dynamics?) in the the long-term. That is, what happens to the distribution of the trait as the number of generations increases?