

MAT 394 - PS5: Some Population Genetics

1.) Suppose that alleles A and B occur with frequencies 0.7 and 0.3 in a randomly-mating population at Hardy-Weinberg equilibrium.

- (a) Use Bayes' theorem to find the conditional distribution of the genotypes of two individuals M and F given that they have a child $c1$ with genotype AA .
- (b) Find the conditional probability that their second child, $c2$, has genotype Aa given that $c1$ has genotype AA . *Hint:* Use your results from (a) along with the law of total probability.

2.) Suppose that alleles A , B and C occur with frequencies 0.5, 0.25 and 0.25 in a randomly-mating population at Hardy-Weinberg equilibrium.

- (a) Calculate the frequencies of the six possible diploid genotypes.
- (b) Suppose that individuals M and F have genotypes AB and BC , respectively. If they have a child $c1$, find the distribution, the mean and the variance of the number of B alleles that this child inherits.

3.) Suppose that alleles $A1$, $A2$, $A3$ and $A4$ occur with global frequencies 0.4, 0.4, 0.1 and 0.1 in a diploid population with inbreeding coefficient $\theta = 0.05$.

- (a) Calculate the probability that a randomly sampled individual is a homozygote.
- (b) Calculate the probability that a random sample of four chromosomes from a subpopulation will contain all four alleles.

4.) In part (c) of problem 5 from PS4, verify that

$$\mathbb{P}(N_f = DD | N_u = WD) = 0.013125.$$

Hint: See the solutions for PS4.