Homework

Due Friday 11-08-2019 at 8:00AM. Show your work!

Problem A. A bi-allelic locus affects oil content (%) in rye with the following genotypic values:

$$A_1A_1 : 9.0\%$$
$$A_1A_2 : 8.9\%$$
$$A_2A_2 : 8.0\%$$

The frequency of A_1 is 0.30 and the population is in Hardy-Weinberg Equilibrium.

1. Given these genotypic values, what are the values of a and d?

2. What is the population mean?

3. What is the mode of inheritance?

Problem B. Consider two more loci that affect oil content, B and C. Assume B_1 and C_1 have exactly the same average effect as A_1. Likewise, B_2 and C_2 have exactly the same average effect as A_2.

1. What is the breeding value of an individual that is $A_1A_2B_1B_2C_1C_2$?

2. What is the breeding value of an individual that is $A_1A_1B_1B_1C_1C_1$?

3. What does the calculated value in question B.2 mean in terms of offspring performance of the individual in question?

4. What is the expected breeding value of an offspring derived from a mating between the two individuals in parts B.1 and B.2?

Problem C. Why is the concept of the average effect of an allele important? Why not just deal with the average effect of a genotype, rather than the average effect of an allele?

Problem D. Assume that passing a course, denoted as P, is a random process that follows a Bernoulli distribution and that the $Pr(P) = 0.7$.

Note the Bernoulli distribution with probability p has density:

$$p(x) = p^x(1-p)^{1-x}$$

for x = 0 or 1.

1. What is $E(P)$?

2. What is $var(P)$?

3. Write down R code to simulate 1000 exams, and calculate the mean and variance of passing the courses?