

# 02-711: Computational Molecular Biology and Genomics

## Quiz # 5

February 18, 2009

**Name:**

You have 15 minutes to complete the quiz. The quiz is closed book. You may use a calculator to do numerical computations. If there are any questions, clarifications, or errors, feel free to talk to the instructor or TA. Please make sure you write your name on the quiz.

### 1 Hardy-Weinberg Equilibrium

In a hypothetical population of  $n$  individuals under the Hardy-Weinberg equilibrium (HWE) with tri-alleles  $A_1$ ,  $A_2$ , and  $A_3$ , it was found that allele counts for  $A_1$ ,  $A_2$ , and  $A_3$  are  $n_{A_1}$ ,  $n_{A_2}$  and  $n_{A_3}$ . Let  $p_{A_1}$ ,  $p_{A_2}$ , and  $p_{A_3}$  be the corresponding allele frequencies.

- (a) Write out the allele frequencies for each allele.

$$p_{A_1} = \frac{n_{A_1}}{2n}$$

$$p_{A_2} = \frac{n_{A_2}}{2n}$$

$$p_{A_3} = \frac{n_{A_3}}{2n}$$

- (b) List all possible genotypes.

$$A_1A_1, A_1A_2, A_1A_3, A_2A_2, A_2A_3, A_3A_3$$

**Common Mistake #1:** A few people included  $A_2A_1$ ,  $A_3A_1$ ,  $A_3A_2$  in addition to the ones above. Please note that order do not matter in genotypes.

**Common Mistake #2:** A few people included answer for triploid organism with tri-allelic site. Please note that one assumption of HWE is the fact that organism is diploid. However, I only deducted one point if you get the concept right.

- (c) Compute the expected frequencies for each genotype.

$$p_{A_1A_1} = p_{A_1}^2, \quad p_{A_1A_2} = 2p_{A_1}p_{A_2}$$

$$p_{A_1A_3} = 2p_{A_1}p_{A_3}, \quad p_{A_2A_2} = p_{A_2}^2$$

$$p_{A_2A_3} = 2p_{A_2}p_{A_3}, \quad p_{A_3A_3} = p_{A_3}^2$$

**Common Mistake #1:** A few people included the probability of mating for all possible genotypes instead of the frequencies of each genotype.

**Common Mistake #2:** Again, some people assumed triploid organism but I only took 1 point off if they get the concept right.