CSS 350
Homework Assignment
Assigned 1/26/01
Due 2/3/01 (by the end of class)

28 possible points, 4 points per question.

Assume the following for questions 1 and 2: The “R” locus\(^1\) controls resistance to a disease, and the “T” locus controls plant height. The R and T loci are on different chromosomes. Two alleles are known at each locus. The possible genotypes and phenotypes for each locus are as follows:

a) “R” is dominant to “r” so that: RR and Rr = resistant; and rr = susceptible
b) “T” is dominant to “t”, so that: TT and Tt = tall; and tt = short

1) A resistant and short plant is self pollinated and the progeny (>50) are all resistant and short. What is the likely genotype of all of these plants? Explain your reasoning.

2) A resistant and short plant is self pollinated and some of the progeny are resistant and short, and some are susceptible and short. What is the likely genotype of the plant that was self pollinated? Explain your reasoning.

3) In a population of 1000 wheat plants you observe 100 tall plants, 500 intermediate height plants, and 400 dwarf plants.

   a) What is the frequency distribution for plant height in this population?

   b) Express the frequency distribution you reported in answer 3a as a ratio of phenotypes.

\(^1\) A “Locus” is a point on a chromosome.
4) If all of the dwarf plants in problem 3 are destroyed,
   a) What will the frequency distribution of plant height be in the remaining population?
   b) What will the ratio of tall to intermediate plants be?

5) Write detailed instructions (how many plants of what generation, etc.) for an experiment that will determine the frequency distribution of flower color in the F2 generation of a cross between a white flowered parent and a purple flowered parent (the same parents Mendel used in one of his experiments, see Fig. 1.8 on page 15 of the text). Assume both parents are true-breeding and that at the starting point of the experiment all you have is parental seed. Include a diagram that illustrates the steps starting from planting of the parents to collection of data on the F2 generation.

6) Now assume that the parents in question 5 also differed for seed shape: the white flower parent had wrinkled seed, and the purple flowered plant had round seeds. Assume this is the same seed shape trait (and gene) that Mendel worked with. Note that this is a Xenia trait. Write additional instructions that explain how the experiment described in question 5 can be used to obtain the frequency distribution of seed shape in the F2 generation. Annotate your diagram in answer 5 to indicate specifically which plants/seeds you are evaluating to determine the F2 generation.

7) Write detailed instructions and create an accompanying diagram that illustrate how to identify and isolate a true breeding line that has round seeds and purple flowers from the F2 plants grown in the experiment you described in your answer to question 6.