# Assignment Summary

For this assignment, you will perform a tetrahybrid cross. As part of this cross, you will apply probability and Mendel’s laws to determine the traits of offspring. You will also analyze the parent, F1 and F2 generations through follow-up questions.

Background Information

Mendel used his experimental data to determine how alleles are passed on through gametes to offspring. The law of segregation states that gametes receive only one of two alleles from parents. The law of independent assortment states that alleles on different chromosomes will separate into gametes independently of one another. These two laws can be used to predict the probability that certain alleles will be passed on from parent to offspring. They can also be used to predict the genotype and phenotype of offspring.

Punnett Squares are useful when completing monohybrid or dihybrid crosses. But, when you are doing more than 2 traits at a time, it becomes too complicated to use a Punnett square. When doing multiple hybrid crosses, one can use the following formula.

If *n* equals the number of traits/genes in question, then:

|  |  |
| --- | --- |
| **Number of F1 gamete types** | **2*n*** |
| **Proportion of F2 homozygous recessives** | **1/(2*n*)2** |
| **Number of different F2 phenotypes (complete dominance)** | **2n** |
| **Number of different F2 genotypes (or phenotypes, if no dominance)** | **3n** |

Materials

* Paper
* Calculator
* Writing and drawing utensils

# Assignment Instructions

For this project, you are expected to submit:

1. The completed assignment section of this guide, featuring calculations and answers to analysis questions.

**Step 1: Prepare for the project.**

1. Read through the guide before you begin so you know the expectations for this project.
2. If there is anything that is not clear to you, be sure to ask your teacher.
3. Pay close attending to the formulas given in the background information.

**Step 2: Calculate the probability of a tetrahybrid cross.**

1. Study the traits that will be involved in the cross below.
   1. Four traits that vary in the plants are:
      1. **seed color** [*yellow* allele (***Y***) is completely dominant over *green* allele (***y***)],
      2. **seed shape** [*round* allele (***R***) is completely dominant over *wrinkled* allele (***r***)],
      3. **pod shape** [*inflated* allele (***I***) is completely dominant over *constricted* allele (***i***)],
      4. **plant height** [*tall* allele (***T***) is completely dominant over *short* allele (***t***)].
      5. The genes are all located on different chromosomes.
2. You can create the Punnett squares needed to answer the questions on scratch paper. You do not need to submit them for grading.

**Step 3: Answer the analysis questions.**

1. Answer the questions in the assignment section of this document.
2. Show your work.

**Step 4: Evaluate your project using this checklist.**

If you can check each box below, you are ready to submit your project.

* Did you use the formulas correctly?
* Did you complete the written wnalysis in the assignment section?
* Did you provide complete answers and show your work?

**Step 5: Revise and submit your project.**

1. If you were unable to check off all of the requirements on the checklist, go back and make sure that your project is complete. Be sure to save your project before submitting it.
2. Turn in your written analysis to your teacher. Be sure that your name is on it.
3. Congratulations! You have completed your project.

Assignment

Answer the questions below. Show your work.

1. Two homozygous plants are crossed. One is dominant for all four traits while the other is recessive for all four traits. What are the genotypes of the parents?
2. How many variations of gametes will the parent produce? Explain your answer.
3. How many gamete possibilities will there be produced by the F1 generation?
4. How many different genotypes and phenotypes will there be in the F2 generation?
5. How does the numbers of phenotypes relate to genetic variation in a population?
6. Suppose 1,000 plants are produced in the F2 population. Predict how many will have green, wrinkled seeds, constricted pods, and short heights.
7. Suppose that the dominant, true-breeding parent was accidently self-pollinated instead of crossed with the true-breeding recessive parent. How would this affect the phenotypes of the F1 and F2 generation?