1. (9 pts) You are exploring the inheritance of two traits in foxglove. The parents indicated in
the crosses below were taken directly from a field near Mt Baker. Different parental plants
were used in each cross.

<table>
<thead>
<tr>
<th>Trait</th>
<th>Alternative phenotypes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color Intensity</td>
<td>Red or pink</td>
</tr>
<tr>
<td>dark spots on throat of flower</td>
<td>spots present or absent</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Progeny phenotypes: number in each class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parental phenotypes</td>
</tr>
<tr>
<td>1. Red spotted X</td>
</tr>
<tr>
<td>Pink unspotted</td>
</tr>
<tr>
<td>2. Red spotted X</td>
</tr>
<tr>
<td>Pink spotted</td>
</tr>
</tbody>
</table>

a. Which are phenotypes are dominant? No explanation needed

*from cross 2: red and spotted*

b. *For each cross* indicate the genotypes of the *parents and progeny* in the space
underneath the phenotype. Use these allele designations *OR* define your own
alleles symbols below. c^R = red   c^p = pink   s^p = spots present   s^A = spots absent

OPTIONAL: define your own allele symbols here:
2. (3 pts.) Circle True or False. The first statement is true and you are to decide if the second statement is True or False. Consider a statement false if any part of it is false.

**FALSE** It is known that many genes are required for pigment formation in the skin or fur of a mammal including those that specify proteins important in the formation of pigment cells, the biosynthesis of melanin and the deposition of pigment granules. *This means that albinism (complete lack of pigment) cannot be inherited as a standard Mendelian single-gene trait.*

One-two sentence explanation/defense of your answer (no credit if no explanation):
As long as the phenotypic variation can be explained by allelic variations in a single gene, the trait is mongenic or a single-gene trait.

NOTE: Just saying that albinism is a single gene trait was not sufficient to get full credit for this question. You needed to directly address the “many gene” issue. See examples below.

**Student Answers:**
This is false because if just one mutation occurs, like the lack of biosynthesis of melanin, then albinism would be seen even if the correct biomachinery for depositing the pigment is present. False, because if failure of any one of those genes to correctly code for synthesis of melanin would cause albinism, so in that sense it is a single-gene trait. Albinism can be inherited as a standard Mendelian single-gene trait b/c it only takes one recessive mutation to rupture the chain of events that from skin pigment. This is false because if an allele does not code or codes incorrectly for any single one of those many factors and creates albinism through this, albinism can be inherited as a single gene Mendelian trait via that allele.

3. (4 pts) Grocery-store banana cultivars are 3n=33 and seedless; wildtype bananas are 2n=22 and have large, hard seeds.

Circle T or F for each statement. Answer false if any part of the statement is false.
**TRUE** In each product of meiosis I in the wildtype banana, there are 11 chromosomes and 22 double-stranded polymers of DNA.
**FALSE** Since n=11, there will be problems during meiosis in both grocery-store and wild bananas.
**TRUE** Even though it has an odd number of genome copies, a 3n plants could be propagated asexually (by mitosis) double-stranded polymers of DNA.
**FALSE** As long as a 3n plants is mated with another 3n plant it can be propagated via normal sexual reproduction and result in seedless bananas.

4. (3 pts.) You test cross a plant of genotype AABbCcDD. What is the probability that a given offspring is heterozygous for each gene. Assume independent assortment.

Show your work and circle your answer.

AABbCcDD X aabbccdd \(\rightarrow\) Aa (p=1) Bb (p=0.5) Cc (p=0.5) Dd (p=1)

Overall probability = 1 X \(\frac{1}{2}\) X \(\frac{1}{2}\) X 1= 1/4
5. (6 pts.) Examine the diagrams shown below which were taken from one your assigned problems in Chapter 3. Each line represents a single polymer of double-stranded DNA. (The DNA polymers will segregate as indicated.)

a. **Diagram #1 (below)**. This drawing is consistent with which of the scenarios listed below? 
   **Choose all correct interpretations (indicated in blue)**
   - a. 1n=2 cell undergoing mitosis
   - b. Meiosis II in a 2n=4 organism of genotype aaBB
   - c. Meiosis II in a 2n=4 organism of genotype AaBb
   - d. Meiosis I in a 2n=4 organism of genotype aaBB
   - e. Mitosis in a 2n=4 organism of genotype aaBB
   - f. Mitosis in a 2n=2 organism of genotype aaBB

   ![Diagram #1](image1.png)

b. **Diagram #2 (below)** Fill in the blanks. This drawing is consistent with a cell of genome content 4n=8 (please use ?n=? format) in anaphase (metaphase OK) of mitosis (circle all correct) Meiosis I Meiosis II.

   ![Diagram #2](image2.png)

   [all B or b chromosomes consist of two dsDNA molecules]

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<table>
<thead>
<tr>
<th>Problem (pts)</th>
<th>Score</th>
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<tbody>
<tr>
<td>1 (9)</td>
<td></td>
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<tr>
<td>2-4 (10)</td>
<td></td>
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<td>5 (6)</td>
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<td><strong>Total (25)</strong></td>
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