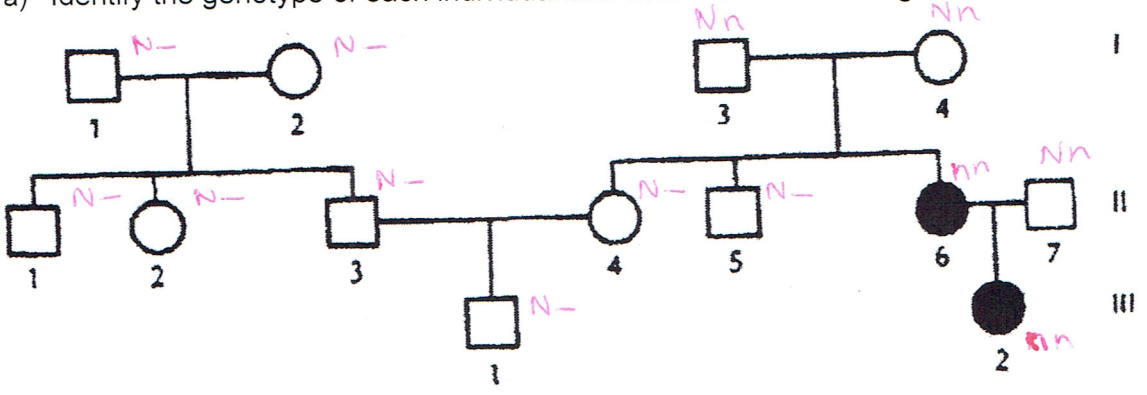
Pedigree Analysis: Problems

Part One: Pedigree Analysis

1. Individuals who lack an enzyme needed to form the skin pigment melanin are called albinos. Normal skin pigmentation is dominant. Use **N** to represent the gene for normal and **nn** to represent the genotype for albinism. If you cannot determine if the dominant trait is heterozygous or homozygous, use **N_**.

   a) Identify the genotype of each individual and write them on the diagram.



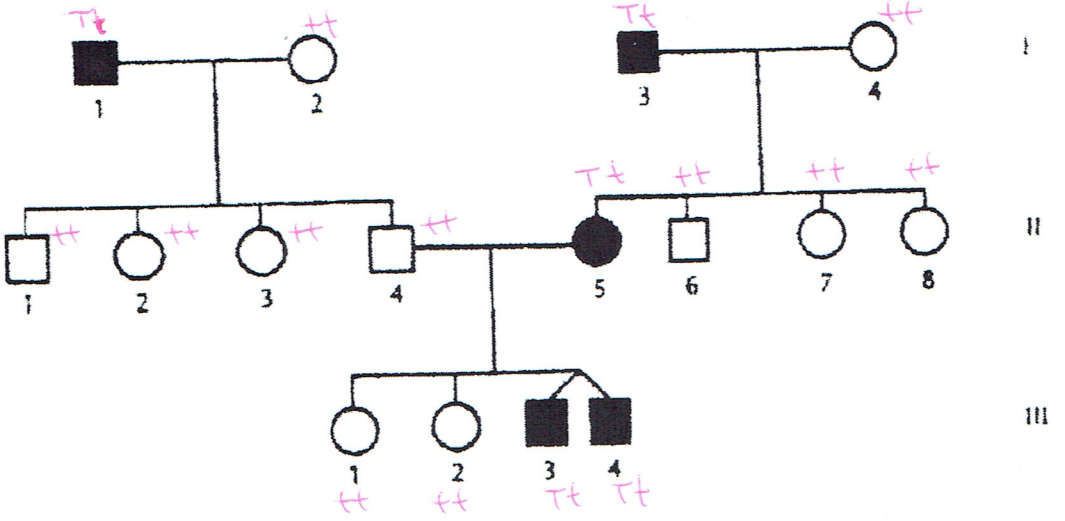
   b) How many individuals had the genotype Nn? 3 How many were N_? 8

   c) Construct a Punnett square to predict the probability of grandparents I-3 and I-4 having albino children. $\frac{1}{4}$ or 25%

   nn ↳ monohybrid Nn x Nn → 1:2:1

2. The following pedigree demonstrates the ability to taste the bitter compound PTC. The ability to taste is a dominant trait and is represented by the letter **T**. Nontasters are represented by **tt** and uncertain genotypes as **T_**.

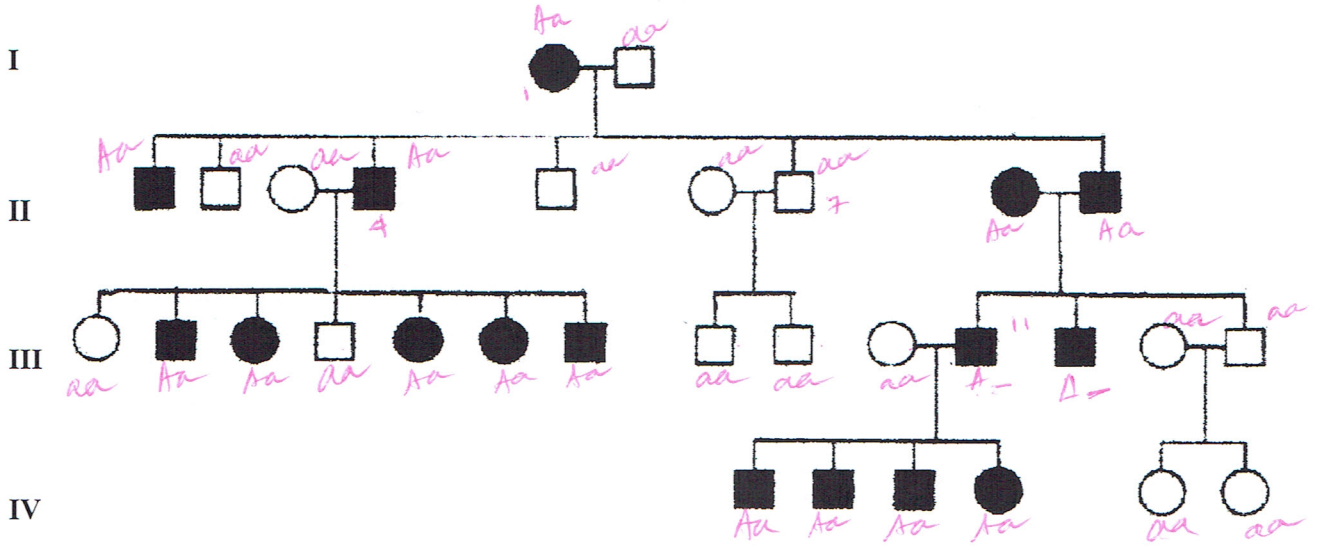
   a) Identify the genotypes as you did in the previous pedigree.



   b) How many individuals are heterozygous? 5 How many are homozygous ? 11

   c) What is the probability of grandparents 3 and 4 having nontaster (tt) offspring ? 50%.

   Tt x tt.



3. This trait is inherited autosomally. How can you tell, based on this pedigree?
~ equal # of males & females have the trait

4. Is the gene for the condition autosomal dominant or recessive? Dominant - affected people have affected parents → every generation

5. Identify the most likely genotype for the following individuals. Use the allele symbols *A/a*.
   a) Individual II-4 Aa
   b) Individual II-7 aa
   c) Individual I-1 Aa
   d) Individual III-11 A-

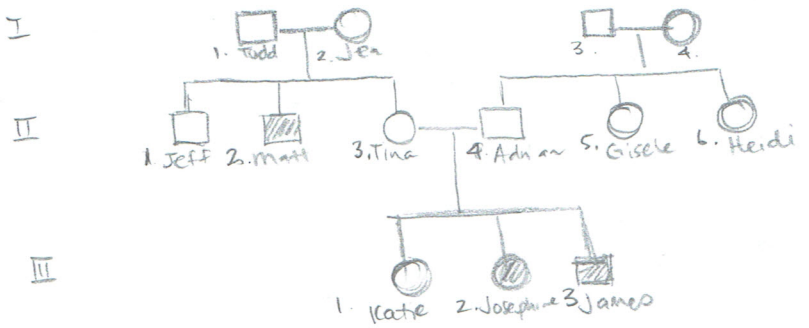
A—

6. Identify the likelihood of producing an affected child from the following pairings. Justify your reasoning.
   a) III-8 and III-13 (aa × aa) 0% chance. Neither person has an A allele to give.
   b) III-7 and III-13 (Aa × aa) 50% chance b/c 50% of III-7's gametes will contain the A allele.

	A	a
a	Aa	aa

Activity Two: Constructing a Pedigree

7. Draw the following pedigree.
   A. Todd and Jennifer have normal pigmentation. They have three children: 2 sons – Jeff (normal), Matthew (albino), and 1 daughter – Tina (normal).
   B. Tina is married to Adrian. Adrian and his two siblings (Gisele and Heidi) all have normal pigmentation. Adrian's parents also have normal pigmentation.
   C. Tina and Adrian have three children. 2 daughters – Katie (normal) and Josephine (albino), and 1 son – James (albino).



8. Label the generations and each individual (by name) in the pedigree.

9. Is albinism a dominant trait or a recessive one? Explain how you can tell, based on this pedigree.
   Recessive - unaffected parents have affected kids (Todd & Jen → Matthew (II-2))

10. Answer the following questions:
    a. What is the genotype of Josephine? nn
    b. What are the genotypes of Todd and Jen? Todd: Nn Jen: Nn
    c. What is the probability that Katie is heterozygous? 2/4 or 50%. {Tina & Adrian each Nn (both): 1 NN : 2 Nn : 1 nn prob.}
       Homozygous dominant? 1/4
    d. Is it possible for Matthew and Heidi to produce an albino child together? Explain.
       Yes. Matthew is nn so it depends on Heidi having an n. At least one of her parents is Nn (her bro. is Nn), so it is possible.