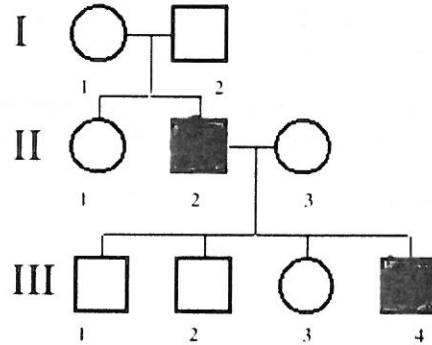


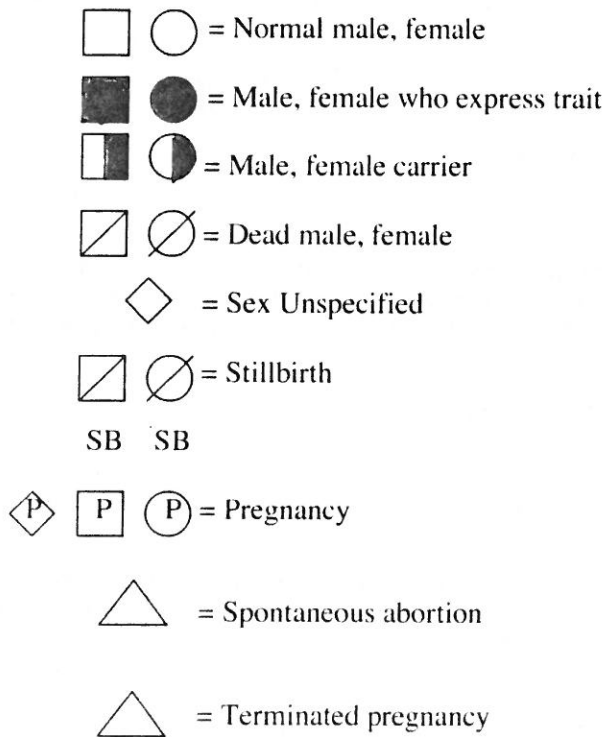
Practice Pedigree Problems

Background:

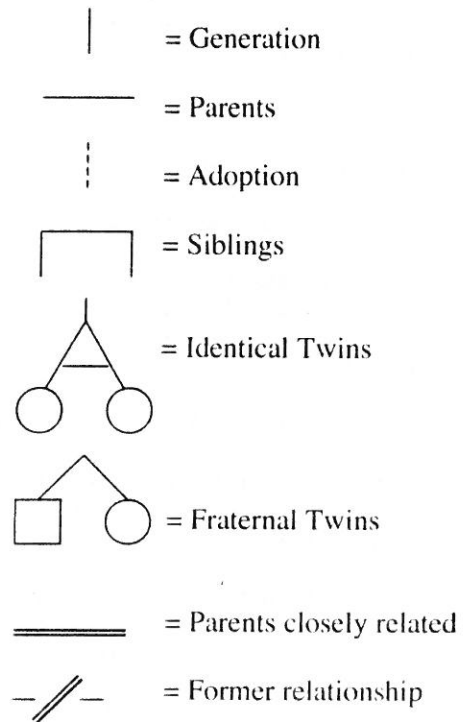
A pedigree is a diagram of family relationships that uses symbols to represent people and lines to represent genetic relationships. These diagrams make it easier to visualize relationships within families. A sample pedigree is below.



Symbols



Lines



Questions

1. On the soap opera "The Young and the Restless", several individuals suffer from a rapid aging syndrome in which a young child is sent off to boarding school and returns three months later an angry teenager. Victims have been known to age up to two decades in variations of the disorder. In the Newman family, siblings Nicholas and Victoria aged from ages six and eight to sixteen and eighteen within a few months. Their parents, Victor and Nikki, are not affected; in fact, they never seem to age at all.

- What is the mode of inheritance of the rapid aging disorder affecting Nicholas and Victoria?
- How do you know what the mode of inheritance is?
- Draw a pedigree to depict this portion of the Newman family.

Name: _____

Date: _____ Period: _____

Pedigree Worksheet

You can look at a pedigree and determine whether traits are dominant or recessive, and you can also tell if it is sex-linked or autosomal. A sex-linked recessive characteristic is determined by an allele that is carried only on the X chromosomes. The shorter Y chromosome does not carry an allele for a sex-linked trait. Since there is only one X in his genotype, XY, a male who carries a particular recessive allele on the X chromosome will have the sex-linked condition. A female who carries a recessive allele in one X chromosome will not show the condition if there is a dominant allele on her other X chromosome. She will express the recessive condition only if she inherits two recessive alleles – one from each parent. Her chances of inheriting the condition are thus greatly reduced.

One sex linked trait is hemophilia, a condition in which the blood does not clot properly. Most people who have hemophilia are men. View the pedigree below and interpret the diagram to answer the questions.

A. Interpreting a human pedigree. (30 points)

Use Figure A to answer the questions below.

- Number all individuals on the pedigree at the top of each shape.
- In a pedigree, a square represents a male. If it is *darkened* he has *hemophilia*; if clear, he had normal blood clotting.
 - How many males are there? _____
 - How many males have hemophilia? _____
- A circle represents a female. If it is *darkened*, she has *hemophilia*; if open she is normal.
 - How many female are there? _____
 - How many females have hemophilia? _____
- A marriage is indicated by a horizontal line connecting a circle to a square.
 - How many marriages are there? _____

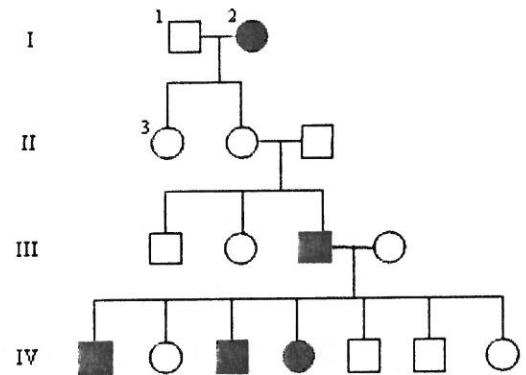


Figure A

- A line perpendicular to a marriage line indicates the offspring. If the line ends with either a circle or a square, the couple had only one child. However, if the line is connected to another horizontal line, then several children were produced, each indicated by a short vertical line connected to the horizontal line. The first child born appears to the left and the last born to the right.
 - How many children did the first couple (couple in row I) have? _____
 - How many children did the third couple (couple in row III) have? _____
- Level I represent the first generation, level II represents the second generation.
 - How many generations are there? _____
 - How many members are there in the fourth generation? _____
- The genotypes of the males in a pedigree for sex-linked inheritance are easy to determine since normal blood clotting (N) is dominant and hemophilia is recessive (n). Since these alleles are on the X chromosome only, a male represented by a clear square will have the genotype $X^N Y$. A darkened square will be $X^n Y$. Label under each individual on the pedigree.
 - What is the genotype for Individual #1? _____ Phenotype? _____
 - What is the genotype for Individual #10? _____ Phenotype? _____
 - What is the genotype for the first born male in generation III? _____ Phenotype? _____
- Females with hemophilia have an easy genotype to identify. They are all $X^n X^n$. Both recessive alleles must be present for a female to have hemophilia. If one dominant allele is present (X^N), the individual would be normal for clotting.
 - How many females have the genotype $X^n X^n$? _____
- Females who do not show the trait for hemophilia may be homozygous dominant ($X^N X^N$) or heterozygous ($X^N X^n$). A heterozygous female is called a carrier. Examination of offspring can often determine which genotype the parents have. If any child (son or daughter) has hemophilia, then the female must be heterozygous. If her son has hemophilia, he has genotype $X^n Y$. He inherited the Y from the father, so the other allele is his genotype (X^n) had to come from the mother. If a daughter has hemophilia ($X^n X^n$), she inherited an X^n from each parent, thus making the genotype for the normal mother $X^N X^n$.
 - What would be the genotype for the female who marries into the family in generation III? _____