Human Biological Sciences Task 15

Term 4 Holiday Homework

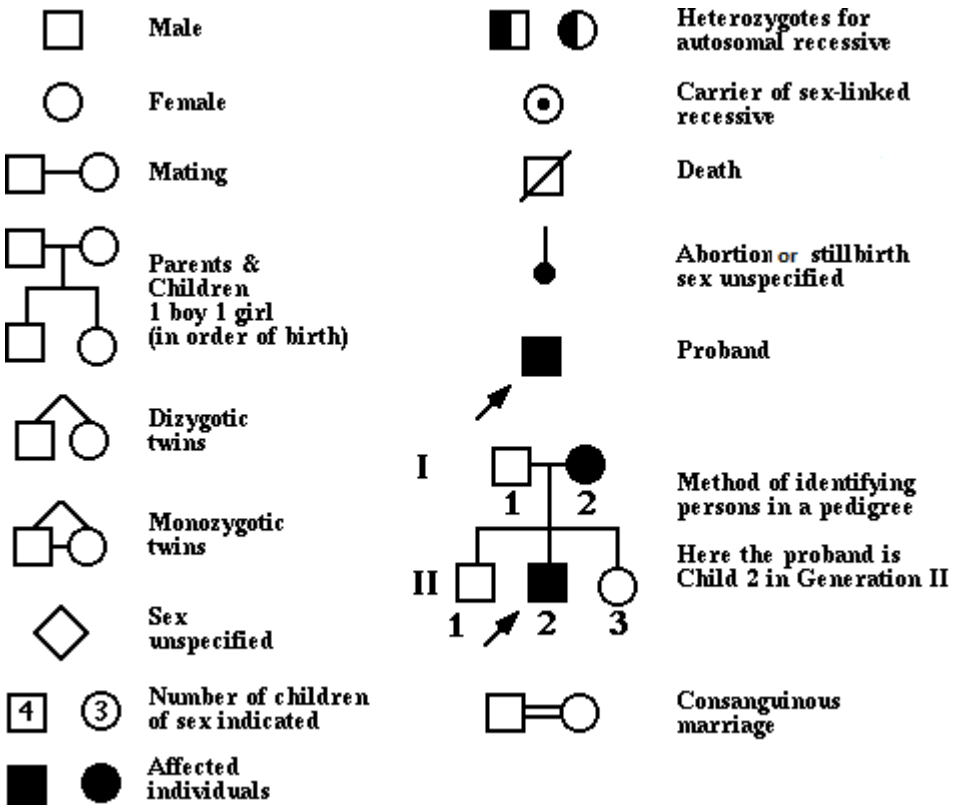
Weighting 5%

<u>Pedigrees</u>

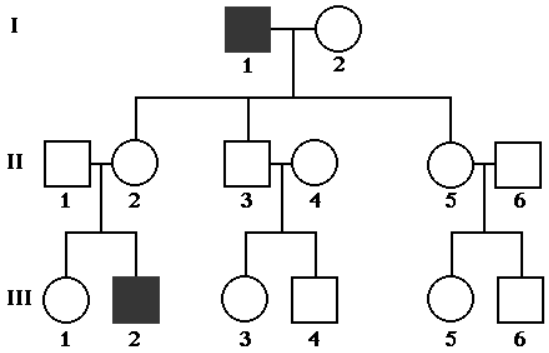
This holiday homework must be submitted complete on Tuesday of Week 1, Term 4, 2017. A validation test on the topics of this holiday homework will be held in Week 2, on a date to be advised. Marks will be lost from the validation test at the rate of 10% per day that the holiday homework is submitted late. Holiday homework will not be accepted if in the opinion of the teacher it has not been completed properly.

A <u>pedigree</u> is a family tree that has been drawn according to a standard scientific format. Pedigrees are useful for studying the inheritance of characteristics and diseases in specific families.

Here are the symbols used on a pedigree.



Answer these questions about the pedigrees shown.



1. Look at the pedigree above. The people whose symbols are shaded black have a disease called haemophilia, which is a bleeding disorder. People with unshaded symbols do not have the disease. (12 marks; 1 mark each except g & h 2 marks)
    a. Is I.2 a man or a woman?

    b. Is II.2 a man or a woman?

    c. How many children do I.1 and I.2 have?

    d. How many brothers does III.1 have?

    e. Who is III.3's father?

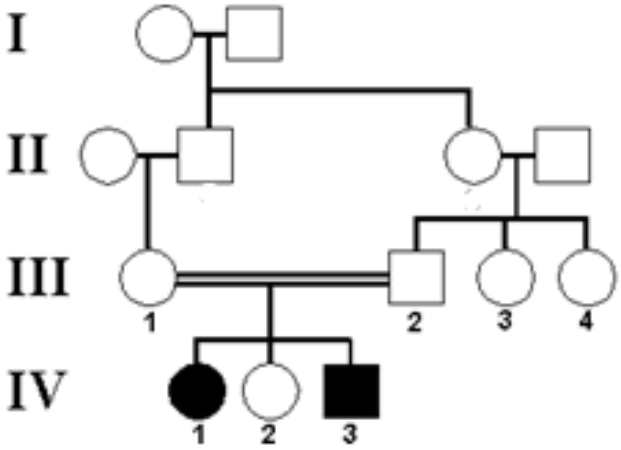
    f. Who is III.3's mother?

    g. Who has the disease haemophilia?

    h. From which of his parents did III.2 inherit the gene for haemophilia? Why?

    i. How many cousins does III.3 have?

    j. How many ***biological*** aunts does III.2 have? (Wives of biological uncles are not considered biological aunts).



2. The pedigree above shows the spread of a disease called albinism in a family, which results in white skin and hair and pink eyes. Look at the pedigree and answer these questions. (7 marks; 1 mark each except 2 marks for e.)
    a. How is I.1 related to III.1?

    b. How is I.2 related to IV.2?

    c. How is IV.1 related to IV.3?

    d. How is IV.3 related to III.2?

    e. How is III.1 related to III.2? (there are two answers)

    f. How is IV.2 related to III.3?

3. You are to collect information about an inherited trait from your family, or from a family you know, and draw a pedigree to show the inheritance of this trait in your family.
    a. Choose one set of your grandparents, either your paternal or maternal grandparents. Draw a pedigree that includes these two grandparents and their descendants, including you and your immediate family. This pedigree should cover at least three generations. Use Roman numerals and numbers to identify individuals in a similar way to the pedigree on page 2 of this document. Draw this pedigree in the space below or on a separate piece of paper if necessary. (4 marks)

b. Collect information about whether or not each of the people in your pedigree can roll their tongue. Classify each person in the pedigree as a tongue-roller or a non tongue-roller. Record your information here. Note – if necessary you may use someone else's family and/or study a different trait e.g. blue eyes. (4 marks)

First name of person (or write 'unknown')	Relationship to you	Tongue-roller (yes/no/unknown)

c. On the pedigree of your grandparents' extended family, shade the symbols of individuals who can roll their tongue (if you studied a different trait, shade the individuals with the trait). Leave unshaded individuals who cannot roll their tongue. (2 marks)

4. A monogenic Mendelian trait can be classified as autosomal, if it is controlled by a gene on any one of chromosomes 1 – 22, or X-linked, if it is controlled by a gene on the X chromosome. Also, the inheritance of a trait can be classified as dominant, if the trait appears in the heterozygote, or recessive, if the trait only appears in the homozygote.

   The mode of inheritance of monogenic Mendelian traits can be classified as one of the following.

   a. Autosomal dominant
   b. Autosomal recessive
   c. X-linked dominant
   d. X-linked recessive

   It is often possible to establish the mode of inheritance of a trait by examining a pedigree of a family with the trait.

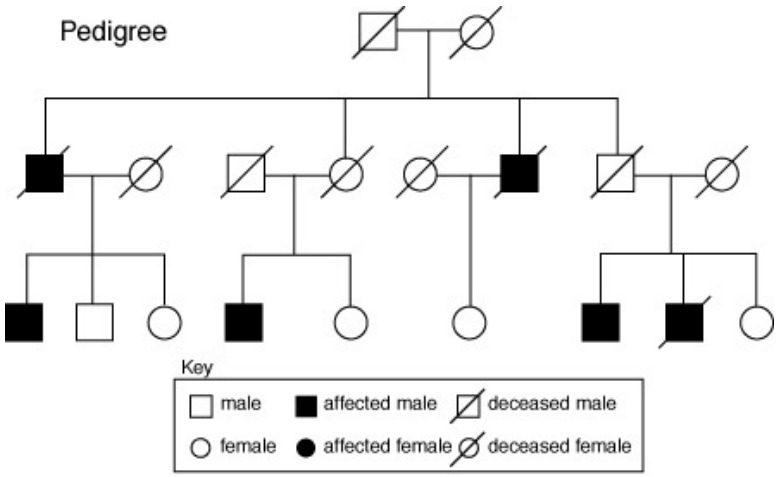
   - If a trait is dominant, then every individual with the trait will have at least one parent with the trait. Therefore, if there is at least one individual with the trait that does not have at least one affected parent, the trait must be recessive.
   - Also, if two parents with the trait have one or more children without the trait, the trait must be dominant.
   - X-linked traits cannot be passed from fathers to sons, because the X-chromosome is not passed from fathers to sons. Therefore, if there is even a single example in a pedigree of father to son inheritance of a trait, the trait must be autosomal.
   - If there is no father to son inheritance and only males are affected, the trait is likely to be X-linked recessive.

   You should now read online further about how to solve the mode of inheritance of a trait. You will not conquer this skill only by reading this document.

5. Solve the following pedigrees by establishing a definite or most likely mode of inheritance. Remember, the mode of inheritance will be one of these four options.
    a. Autosomal dominant
    b. Autosomal recessive
    c. X-linked dominant
    d. X-linked recessive

(For each pedigree, 1 + 2 = 3 marks)

The first one has been done as an example for you.



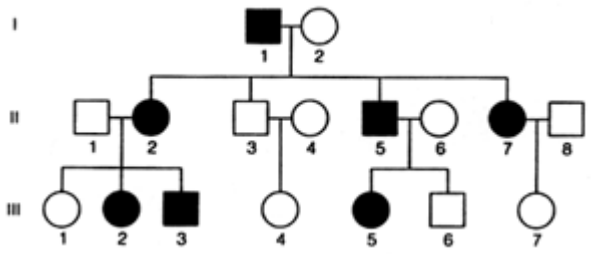
Possible mode/s of inheritance: ***Autosomal recessive.***

Reasons:

The mode of inheritance must be recessive because there are individuals with the trait that do not have at least one affected one parent e.g. II.1, II.6.

The mode of inheritance must be autosomal because there is father to son transmission of the trait e.g. II.1 to III.1.

Therefore, the mode of inheritance must be autosomal recessive.



Possible mode/s of inheritance _____

Reasons _____

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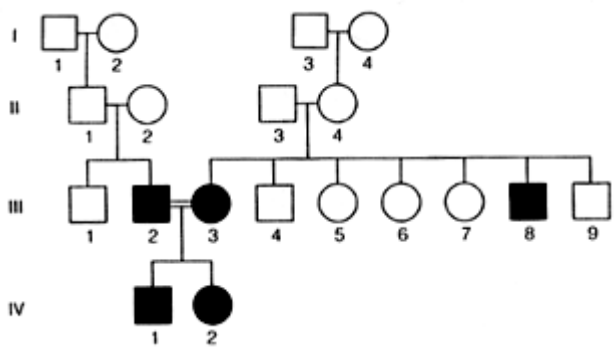

Possible mode/s of inheritance _____

Reasons _____

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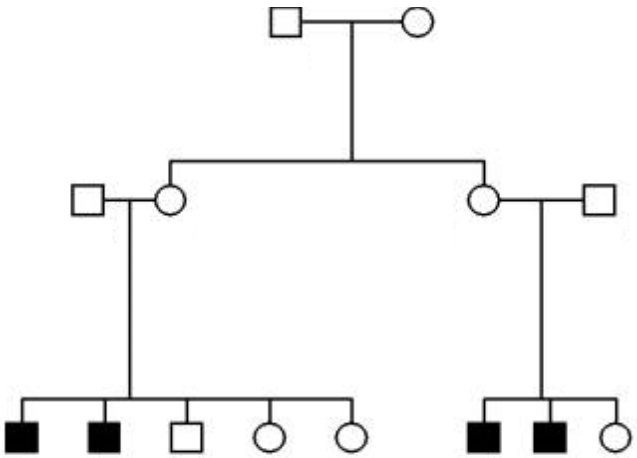

Possible mode/s of inheritance _____

Reasons _____

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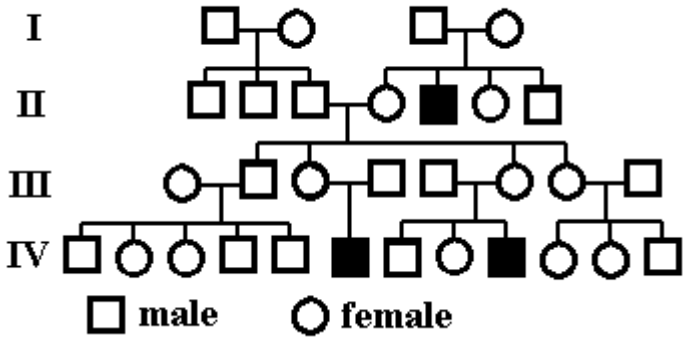

Possible mode/s of inheritance _____

Reasons _____

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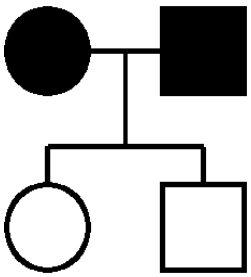

Possible mode/s of inheritance _____

Reasons _____

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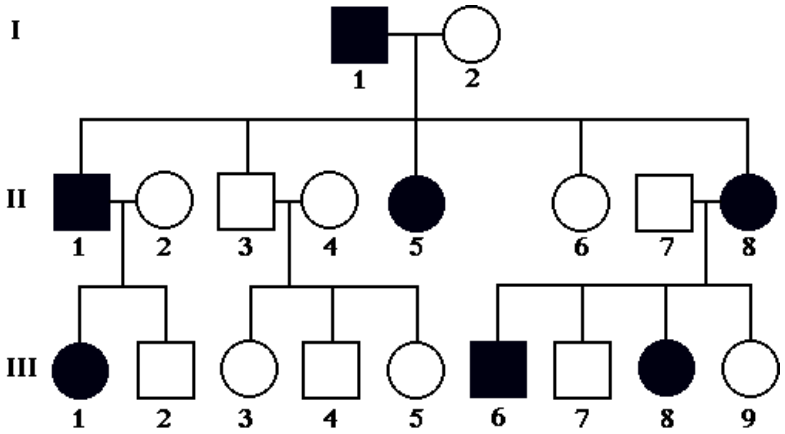

Possible mode/s of inheritance _____

Reasons _____

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