BIOL 2030 Exam 1 Name_____

1. (10 pts.) Sickle cell anemia is a recessive trait in humans. In a cross between a father who has sickle cell anemia and a mother who is heterozygous for the gene, what is the probability that all of their first three children will be normal? Briefly explain.

½ x ½ x ½ = 1/8

2. (10 pts.) The dominant trait, Huntington disease causes severe neural/brain damage at approximately age 40. A female whose mother has Huntington disease, marries a male whose parents are normal. It is not known if the female has the disease. What is the probability that their first-born will inherit the gene that causes Huntington disease? Show your work.

½ x ½ = 1/4

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3. (10 pts.) In a monohybrid cross AA × aa, what proportion of heterozygotes is expected among the F_2 offspring?

1/2

4. (10 pts.) In a dihybrid cross AAbb × aaBB, what proportion of the F_2 will be homozygous at both genes?

1/4

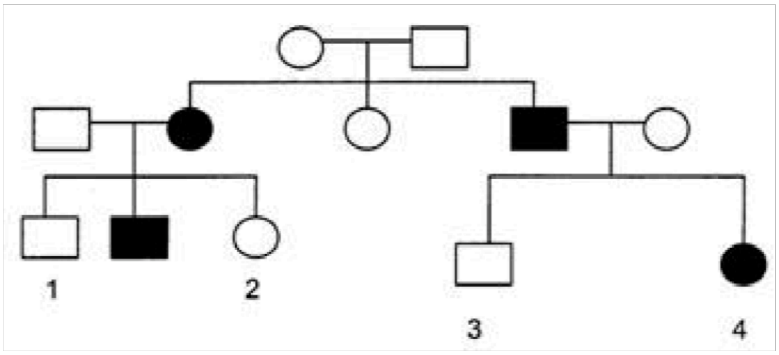
5. (10 pts.) In corn ligules, (L) is dominant to liguleless (l) and a green leaf (G) is dominant to the normal non-green (g). If a plant homozygous for liguleless and green leaves is crossed to one homozygous for ligules and non-green predict the phenotypes and proportions of the F_2.

9 green ligules
3 green liguless
3 non-green ligules
1 non-green liguless

6. (10 pts.) In corn, three dominant genes are necessary for aleurone color. The genotype B__D__R is colored. Any homozygous recessive for one gene is colorless. What is the phenotypic ratio in the offspring of the cross BbDdRr × BbDdRr ?

colored = ¾ x ¾ x ¾ = 27/64
colorless = 37/64

7. (10 pts.) Below is a pedigree of a human genetic disease in which stricken individuals are solid-colored. Calculate the probability that an offspring of the cousin marriage **2 × 3** will have the disease.



one-fourth

8. (15 pts.) Red-green color-blindness is controlled by a recessive allele of an X chromosomal gene in humans. A normal man and woman whose fathers are both color-blind marry. What is the probability that their first child will be color-blind?

½ x ½ = 1/4

9. (15 pts.) Coat color in a certain species of rabbit is governed by multiple alleles. The hierarchy with reference to dominance for these alleles is as follows: Colored (c^+), Chinchilla, (c^{ch}), Himalayan (c^h) and Albino (c). Give the phenotypes and ratios from the following crosses.

$c^+ c \times c^h c^h$

½ colored, ½ himalayan

$c^+ c^+ \times c^h c^{ch}$

all colored

$c^+ c \times c^h c$

1/2 colored, ¼ Himalayan, ¼ albino

$c c \times c^h c^{ch}$

½ Himalayan, ½ chinchilla

$c^+ c^{ch} \times c^h c^{ch}$

½ colored, ½ chinchilla

10. (**10 bonus pts.**) A female fruit fly with vermilion eyes and normal wings is crossed to a male with normal red eyes and cut wings. The F_1 progeny consist of females with red eyes and normal wings, and males with vermilion eyes and normal wings. When the F_1 progeny are interbred, the F_2 consists of two types of females — vermilion eyes, normal wings (1/2) and red eyes, normal wings (1/2), and two types of males — vermilion eyes, normal wings (1/2) and red eyes, cut wings (1/2). Are the genes for eye-color and wing-type X-linked or autosomal? Diagram the crosses and indicate the appropriate genotypes for the males and females at each stage.

vermilion = sex-linked

cut wings = sex-linked

P: v ct+/v ct+ females x v+ ct males

F1: v ct+/v+ ct females x v ct+ males

F2: v ct+/v ct+ and v+ ct/v ct+ females
v ct+ and v+ ct males