7.03 Exam 1

Name: _____

TA (circle one):

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Doug Mills	Rishi Puram	Bethany Redding	Nate Young

Section time: _____

Exam starts at 11:05 and ends at 11:55

There are eight pages including this cover page.
Please write your name on each page.

Please...

• Look over the entire exam so you don't spend too much time on hard questions leaving easy questions unanswered.

• Check your answers to make sure that they make sense.

• To help us give partial credit, show your work and state any assumptions that you make.

Question 1	**26 points**
Question 2	**36 points**
Question 3	**38 points**

Name: _____

1. Consider the following autosomal *Drosophila* traits caused by recessive alleles: bent wings (**bn**$^{-}$), short legs (**sh**$^{-}$), and orange eyes (**or**$^{-}$). You cross two true breeding lines to produce F1 flies, all of which have the wild type phenotype (strait wings, long legs, and red eyes). F1 females are then mated to triply homozygous males with bent wings, short legs, and orange eyes. Among 100 progeny from this cross you observe the following phenotypes:

Phenotype	Number
strait wings, long legs, and red eyes	10
bent wings, short legs, and orange eyes	14
strait wings, short legs, and red eyes	26
bent wings, long legs, and orange eyes	30
strait wings, long legs, and orange eyes	8
bent wings, short legs, and red eyes	6
strait wings, short legs, and orange eyes	2
bent wings, long legs, and red eyes	4

(a 6 points**)** What were the genotypes of the two true breeding parental lines that were crossed?

(b 12 points**)** Draw a genetic map showing the order and relevant distances in cM of the **bn**, **sh**, and **or** markers.

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(c 8 points**)** A colleague calls to tell you she plans to carry out the following two-factor cross. A true breeding line with bent wings will be crossed to a true breeding line with short legs (unless specified other traits appear normal). F1 flies will then be crossed to a true breeding strain with bent wings and short legs. Your colleague wants to know what proportion of the progeny from this cross will have bent wings and short legs. What would you tell her?

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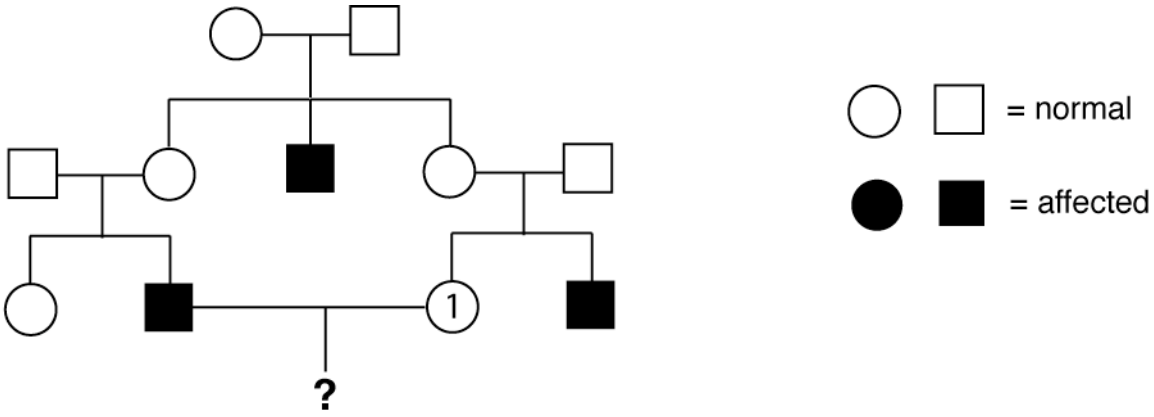
2. The pedigree shows inheritance of an X-linked recessive trait. (Assume the trait is completely penetrant).



(a 4 pts.**)** What is the probability that the female designated **1** is a carrier for the trait?

(b 6 pts.**)** If the child indicated by **?** is a boy, what is the probability he will be affected by the trait?

(c 6 pts.**)** If the child indicated by **?** is a girl, what is the probability she will be affected by the trait?

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(d 8 pts.**)** If the child indicated by **?** is affected by the trait, what is the probability that the couple's next child will be affected by the trait?

(e 12 pts.**)** If the child indicated by **?** is not affected by the trait, calculate the new probability that the female designated **1** is a carrier for the trait.

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3. You have isolated two different yeast mutants called *cys1*$^-$ and *cys2*$^-$ that cannot synthesize the amino acid cysteine and therefore require cysteine added to the medium for growth (i.e. they are Cys$^-$).

(a 4 points**)** You mate a *cys1*$^-$ mutant to a *cys2*$^-$ mutant. The resulting diploids don't require cysteine (i.e. they are Cys$^+$). What does this tell you about the *cys1*$^-$ and *cys2*$^-$ mutations?

Next, you sporulate the diploid from part (**a**). Among the 50 tetrads analyzed three different tetrad types are found

Type:	4 Cys$^-$	3 Cys$^-$: 1 Cys$^+$	2 Cys$^-$: 2 Cys$^+$
Number:	39	10	1

(b 6 points**)** Say that you want a *cys1*$^-$*cys2*$^-$ double mutant. What is the easiest way to obtain such a mutant without further analysis?

(c 6 points**)** You choose one of the tetrads for further analysis and the four spores have the following properties: Spore 1 = MAT**a** Cys$^+$, Spore 2 = MAT**a** Cys$^-$, Spore 3 = MATα Cys$^-$, and Spore 4 = MATα Cys$^-$. You carry out the matings that are possible and find that the diploid produced by mating Spore 2 to Spore 3 is Cys$^-$, while the diploid produced by mating Spore 2 to Spore 4 is Cys$^+$. Which spore is the double mutant? Explain your reasoning.

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(d 6 points**)** Given the number of tetrads of each type, what is the distance between the *cys1*$^-$ and *cys2*$^-$ mutations?

You have isolated a mutation that you call *cysX*$^-$ that activates an alternative pathway for cysteine synthesis. A *cysX*$^-$ mutation on its own is Cys$^+$, and when a *cysX*$^-$ mutation is combined with a *cys1*$^-$ mutation, the double mutant is Cys$^+$.

(e 8 points**)** Describe the cross you would perform and the interpretation of the outcome that you would use to determine whether *cysX*$^-$ is dominant or recessive?

(f 8 points**)** Say that *cysX*$^-$ is 5 cM away from *cys1*$^-$. In a cross of a MAT**a** *cysX*$^-$ mutant to a MATα *cys1*$^-$ mutant what types of tetrads (in terms of the proportion of Cys$^-$: Cys$^+$) would you expect to find and how many of each type would you expect from a total of 50 tetrads?

Grading section

Question 1 26 points:_____

Question 2 36 points:_____

Question 3 38 points:_____

Total :_____