

STUDENT NAME _____

BICD100
FALL 2004
REINAGEL

MIDTERM 1

INSTRUCTIONS

1. You may bring a single sheet of notes (8.5 x 11", both sides), which must be turned in with your exam. All other books, papers, and materials must be left in the aisles.
2. You may use a hand calculator. All other electronics including cell phones and pagers must be left in the aisles.
3. You must **WRITE YOUR NAME ON EVERY PAGE**
4. Sit as far as possible from other students.
5. Exams will be collected at exactly 4:45PM
6. If you want your graded exam to be left for you to pick up in Pacific Hall 3rd Floor Lobby, you must sign a release here:
_____.
7. If you do not sign the release, you can pick up your exam from your TA in section (Name of your TA _____.)

Table 2-2 Critical Values of the χ^2 Distribution

df	P									df
	0.995	0.975	0.9	0.5	0.1	0.05	0.025	0.01	0.005	
1	.000	.000	0.016	0.455	2.706	3.841	5.024	6.635	7.879	1
2	0.010	0.051	0.211	1.386	4.605	5.991	7.378	9.210	10.597	2
3	0.072	0.216	0.584	2.366	6.251	7.815	9.348	11.345	12.838	3
4	0.207	0.484	1.064	3.357	7.779	9.488	11.143	13.277	14.860	4
5	0.412	0.831	1.610	4.351	9.236	11.070	12.832	15.086	16.750	5
6	0.676	1.237	2.204	5.348	10.645	12.592	14.449	16.812	18.548	6
7	0.989	1.690	2.833	6.346	12.017	14.067	16.013	18.475	20.278	7
8	1.344	2.180	3.490	7.344	13.362	15.507	17.535	20.090	21.955	8
9	1.735	2.700	4.168	8.343	14.684	16.919	19.023	21.666	23.589	9
10	2.156	3.247	4.865	9.342	15.987	18.307	20.483	23.209	25.188	10
11	2.603	3.816	5.578	10.341	17.275	19.675	21.920	24.725	26.757	11
12	3.074	4.404	6.304	11.340	18.549	21.026	23.337	26.217	28.300	12
13	3.565	5.009	7.042	12.340	19.812	22.362	24.736	27.688	29.819	13
14	4.075	5.629	7.790	13.339	21.064	23.685	26.119	29.141	31.319	14
15	4.601	6.262	8.547	14.339	22.307	24.996	27.488	30.578	32.801	15

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Question 1. (5 points)

You perform a cross between a red geranium and a white geranium of unknown genotypes, and all the progeny have red flowers (F1). You cross the F1 progeny with one another and you get 43 red-flowered geranium plants and 13 white-flowered geranium plants in the F2 generation.

cross 1: red geranium **X** white geranium (P)
gives F1: all red

cross 2: red F1 **X** red F1
gives F2:
43 red
13 white

- a) Using letters of your own choosing, state the most likely genotypes of the two parents (P) in cross 1, stating which phenotypes are dominant and using a capital letter for the dominant alleles.
- b) Based on your answer to part (a), state the expected genotypes of the F1, and in what ratio they should occur
- c) Based on your answers to parts (a) and (b), state the expected genotypes of the F2 (progeny in cross 2), and in what ratio they should occur
- d) State the phenotype of each genotype in the F2 and use this to predict the phenotypic ratios in the F2 generation
- e) Use a Chi Square test to determine whether the observed data are consistent with your model. Show your work and put a box around the χ^2 value, the P value, and your yes/no answer.

Question 2. (2 ½ points)

You discover that a laboratory strain of gerbils is deaf and you decide to use it as a model for hereditary deafness. You cross a purebred deaf gerbil to a purebred gerbil that can hear (“hearing” phenotype). All the F1 progeny have partial hearing loss (“hard-of-hearing” phenotype). You then cross the hard-of-hearing F1 gerbils to one another, and you obtain 27 deaf, 49 hard-of-hearing, and 24 hearing gerbils in the F2 generation.

cross 1: deaf gerbil **X** hearing gerbil
gives F1: all hard-of-hearing

cross 2: hard-of-hearing F1 **X** hard-of-hearing F1
gives F2:
27 deaf
49 hard-of-hearing
24 hearing

- a) Using letters of your own choosing, state the most likely genotypes of the original two parents, stating which phenotypes are dominant and using a capital letter for the dominant alleles.

- b) What is the genetic term used to explain the phenotype of the F1?

- c) Based on your answer in (a), state the expected genotypes of the F2, and in what ratio they should occur

- d) Based on your answers in (a) through (c), state the phenotype of each genotype in the F2 and use this to explain the phenotypic ratios in the F2 generation

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Question 3 (3 points)

There are two purebred varieties of horses, one that has a black coat with a red mane, and another that has a brown coat with a white mane. You are determined to get a horse with a black coat and a white mane. You arrange several crosses between the two purebred varieties, and all the F1 progeny are identical. Unfortunately all the F1 horses are stolen and you can't remember what they looked like. Fortunately, before the F1 horses were stolen, you had already obtained 100 F2 (progeny from mating the F1 hybrids with each other). The F2 phenotypes are as follows:

7	brown coat, white mane
24	black coat, white mane
50	black coat, red mane
19	brown coat, red mane

- a) Which phenotypes are dominant?

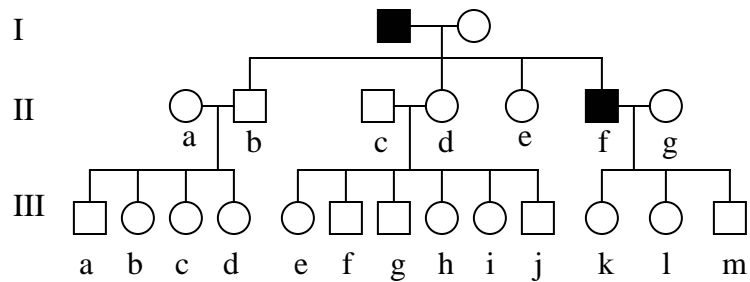
- b) Using letters of your own choosing, write out the likely genotypes of the two parental varieties, stating which phenotypes are dominant and using a capital letter for the dominant alleles.

- c) Infer the probable phenotype of the missing F1 horses so you can file a police report.

- d) Demonstrate how you can predict the ratios of the F2 phenotypes on the basis of your model of the genotypes and the phenotypes associated with each genotype.

Question 4 (3 points)

The following pedigree is for a family with a history of a rare, late-onset disease caused by a single, dominant mutation. Those individuals who are already suffering from the disease are shaded black. However, some additional individuals in generations II and III also have the mutant allele and will develop the disease but have not yet shown symptoms. Assume that individuals marrying into the family have no history of the disease (that is, they are homozygous recessive for the gene). Also assume that the diseased male in generation I is heterozygous for the disease gene.

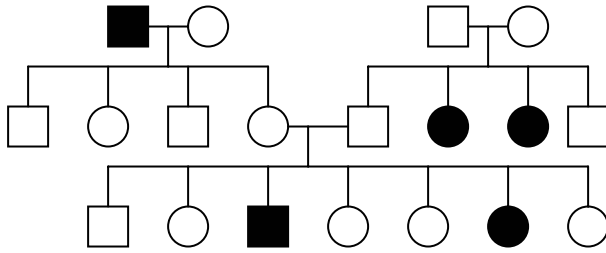


- Is this disease X-linked or autosomal?
- If individuals III_m and II_a had a child together, what is the probability that the child would develop Huntington disease? Show your work, circle your answer.

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Question 5 (4 points)

A family with a rare disorder presents the following family tree:



- What is the most likely mode of inheritance?
- Cite the 2 facts about the pedigree that give the most support for your conclusion.
- Circle all individuals that **MUST** be heterozygous

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Question 6 (2 ½ points)

The two parents of a cross have the genotypes:

Parent 1 Aa BB cc Dd EE ff

Parent 2 AA Bb Cc DD ee Ff

- a) How many different genotypes can the progeny of this cross have? How many different phenotypes?

- b) What fraction of the progeny will have the same phenotype as Parent 2?

- c) In the progeny of this cross, how many different genotypes could produce the phenotype A_B_ccD_E_ff?

