

Introduction to Genetics

FALL 2010

EXAM II

Questions 1-4 refer to the following experiment

An experiment to determine if incomplete dominance governs flower color in snapdragons crossed two plants with pink flowers. The following progeny were recovered from the cross: 15 plants had red flowers, 55 had pink flowers and 30 had white flowers.

1. If flower color in snapdragons follows a Mendelian pattern of inheritance, the expected number of progeny for each class would be?

- A) 15 red, 55 pink, 30 white
- B) 33.3 red, 33.3 pink, 33.3 white
- C) 25 red, 50 pink, 25 white
- D) 75 red, 25 white
- E) 25 red, 75 white

2. What is the Chi-square value for the test of whether the observed numbers are consistent with a Mendelian pattern of inheritance?

- A) 0.00 B) 0.70 C) 1.33 D) 2.25 E) 5.50

3. How many degrees of freedom are involved in this experiment?

- A) 0 B) 1 C) 2 D) 3 E) 4

4. Base on the P value, what can be said about the pattern of inheritance in the progeny of this experiment?

- A) $P > 0.05$. The observed ratios are statistically consistent with a Mendelian pattern of inheritance
- B) $P > 0.05$. We can reject the hypothesis that these progeny follow a Mendelian pattern of inheritance
- C) $P < 0.05$. The observed ratios are statistically consistent with a Mendelian pattern of inheritance
- D) $P < 0.05$. We can reject the hypothesis that these progeny follow a Mendelian pattern of inheritance
- E) $P = 0.05$. There is a 5% chance that the progeny follow a Mendelian pattern of inheritance

Questions 5-7 refer to the following experiment.

In a testcross experiment that produced 100 progeny, 9 were double recombinants and the following rate of recombination was observed for the genes below:

$k-m$.30
$k-l$	0.65
$l-m$	0.40

5. The order of the three genes is

- A) k-m-l B) k-l-m C) l-k-m D) the order cannot be determined E) only k-m are linked

6. In the absence of interference, what rate of double crossovers would be *expected* to occur between these three genes?

- A) 0.07 B) 0.12 C) 0.23 D) 0.50 E) 0.80

7. The degree of interference for this region is

- A) 0.15 B) 0.25 C) 0.30 D) 0.75 E) 0.80

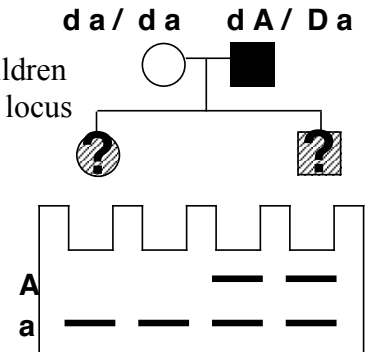
Questions 8-12 refer to the following experiment

Two plants of genotype *AABB* and *aabb* are crossed. The F₁ progeny are then testcrossed to a plant of genotype *aabb* and the F₂ progeny are examined.

8. If the genes are unlinked, the *total* percentage of recombinants will be
 A) 12.5% B) 25% C) 37.5% **D) 50%** E) 75%
9. If the genes are unlinked, the percentage of *Aabb* progeny will be
 A) 12.5% **B) 25%** C) 37.5% D) 50% E) 75%
10. If the genes are linked, and 25 map units apart, the percentage of *Aabb* progeny will be
A) 12.5% B) 25% C) 37.5% D) 50% E) 75%
11. If the genes are linked, and 25 map units apart, the percentage of *aabb* progeny will be
 A) 12.5% B) 25% **C) 37.5%** D) 50% E) 75%
12. If the genes are linked, and 25 map units apart, in the absence of recombination, the percentage of *Aabb* progeny will be
A) 0% B) 12.5% C) 25% D) 50% E) 100%

Questions 13-16 refer to the following pedigree.

A man with a rare autosomally dominant Disease (D) has two children with an unaffected female. The Disease locus (D) is 80% linked to the A locus and the chromosomal genotype of each parent is shown.



13. The daughter inherited
 A) The “A” allele from her dad and the “a” allele from her mom
 B) The “a” allele from her dad and the “A” allele from her mom
C) The “a” allele from her dad and the “a” allele from her mom
 D) The “A” allele from her dad and the “A” allele from her mom
 E) It is impossible to determine the allele by each which parent.
14. The son inherited
A) The “A” allele from her dad and the “a” allele from her mom
 B) The “a” allele from her dad and the “A” allele from her mom
 C) The “a” allele from her dad and the “a” allele from her mom
 D) The “A” allele from her dad and the “A” allele from her mom
 E) It is impossible to determine the allele by each which parent.
15. The probability that the daughter will be affected by the disease is
 A) 0% B) 20% C) 50% **D) 80%** E) 100%
16. The probability that the son will be affected by the disease is
 A) 0% **B) 20%** C) 50% D) 80% E) 100%

Questions 17-21 refer to the following experiment.

Smurfs are imaginary creatures who are normally blue (*B*), fuzzy (*F*), and industrious (*I*). Data from a three-point testcross of these three linked genes are shown below.

Phenotype	Genotype	Number
Normal	<i>Bb, Ff, Ii</i>	400
White	<i>bb, Ff, Ii</i>	60
Bald	<i>Bb, ff, Ii</i>	10
Lazy	<i>Bb, Ff, ii</i>	30
white, bald	<i>bb, ff, Ii</i>	20
white, lazy	<i>bb, Ff, ii</i>	10
bald, lazy	<i>Bb, ff, ii</i>	70
white, bald, lazy	<i>bb, ff, ii</i>	400
Total:		1000

17. What were the parental genotypes of this testcross?

- A) *BFI / bFI* **B) *BFI / bfi*** C) *Bfi / bFi* D) *Bfi / bfi* E) *BFI / BFI*

18. What is the distance in map units between the *B* and *F* genes?

- A) 2 mu B) 7 mu **C) 15 mu** D) 18 mu E) 20 mu

19. What is the distance in map units between the *F* and *I* genes

- A) 2 mu **B) 7 mu** C) 15 mu D) 18 mu E) 20 mu

20. What is the distance in map units between the *I* and *B* genes

- A) 2 mu B) 7 mu C) 15 mu **D) 18 mu** E) 20 mu

21. What is order of the three genes?

- A) B-F-I** B) F-I-B C) I-B-F D) A or B could be correct E) B or C could be correct

22. A chromosome with its centromere in the middle is called

- A) submetacentric **B) metacentric** C) acrocentric D) telocentric E) holocentric

23. The chromosome designation 11p refers to

- A) the long arm of chromosome 11.
 B) a partial deletion of chromosome 11.
 C) a specific band on chromosome 11.
 D) an inversion on chromosome 11.
E) the short arm of chromosome 11.

24. The products of crossing-over within the paracentric inversion include

- A) submetacentric chromosome.
 B) Robertsonian translocation.
C) a dicentric and an acentric chromatids.
 D) two monocentric chromatids with deletions and duplications.
 E) normal chromosomes

Questions 25-30 refer to the following experiment.

The yeast *Saccharomyces cerevisiae* has unordered tetrads. In a cross made to study the linkage relations between three genes, the following tetrads were obtained. The cross was between a strain of genotype *A b c* and one of genotype *a B C*.

Tetrad	Genotypes of spores in tetrads				# of tetrads
1	<i>aBC</i>	<i>aBC</i>	<i>Abc</i>	<i>Abc</i>	130
2	<i>abC</i>	<i>abC</i>	<i>ABc</i>	<i>ABc</i>	120
3	<i>aBC</i>	<i>aBc</i>	<i>AbC</i>	<i>Abc</i>	70
4	<i>abC</i>	<i>abc</i>	<i>ABC</i>	<i>ABc</i>	80
Total					400

25. The correct classification of tetrads 1, 2, 3, and 4 with respect to A and B is

- A) NPD, PD, NPD, PD
- B) PD, NPD, PD, NPD
- C) PD, NPD, TT, TT
- D) PD, PD, TT, TT
- E) PD, NPD, NPD, PD

27. The correct classification of tetrads 1, 2, 3, and 4 with respect to B and C is

- A) NPD, PD, NPD, PD
- B) PD, NPD, PD, NPD
- C) PD, NPD, TT, TT
- D) PD, PD, TT, TT
- E) PD, NPD, NPD, PD

29. The correct classification of tetrads 1, 2, 3, and 4 with respect to A and C is

- A) NPD, PD, NPD, PD
- B) PD, NPD, PD, NPD
- C) PD, NPD, TT, TT
- D) PD, PD, TT, TT
- E) PD, NPD, NPD, PD

26. The distance in map units between the A and B genes is

- A) 10.0 mu
- B) 18.8 mu
- C) 25.0 mu
- D) 37.5 mu
- E) A and B are unlinked

28. The distance in map units between the B and C genes is

- A) 10.0 mu
- B) 18.8 mu
- C) 25.0 mu
- D) 37.5 mu
- E) B and C are unlinked

30. The distance in map units between the A and C genes is

- A) 10.0 mu
- B) 18.8 mu
- C) 25.0 mu
- D) 37.5 mu
- E) A and C are unlinked

Questions 31-33 refer to the following family.

A male and female are both heterozygous for the autosomal recessive allele for albinism. They have four children.

31. What is the probability that their oldest child has albinism?

- A) ~0.105
- B) ~0.141
- C) 0.250
- D) ~0.316
- E) ~0.422

32. What is the probability that only their oldest child has albinism?

- A) ~0.105
- B) ~0.141
- C) 0.250
- D) ~0.316
- E) ~0.422

33. What is the probability that only one of their children has albinism?

- A) ~0.105
- B) ~0.141
- C) 0.250
- D) ~0.316
- E) ~0.422

