

Tentamen, Genetik (NBIA24, 91BI11, 91BI17, 92BI11, 92BI17 och TFBI11), 19/8 2015

Sist i häftet hittar du svarsblanketten. Fyll i rätt svar på denna och lämna in.

Betygsgränser:

NBIA24, TFBI11: U: 0 - 31, 3: 32 - 37, 4: 38 - 43, 5: 44 - 50

91BI11, 91BI17, 92BI11, 92BI17: U: 0 - 31, G: 32 - 42, VG: 43 - 50

LYCKA TILL!

1. In pea the letter a can refer to
 - (a) An allele at the locus for flower colour
 - (b) The flower colour phenotype of an individual
 - (c) The flower colour genotype of a gamete
 - (d) More than one of a - c.
 - (e) All of a - c.
2. Which of the following statements about an animal bearing a somatic mutation is true?
 - (a) Some but not all of the animal's offspring will also carry the mutation.
 - (b) All of the animal's offspring will carry the mutation.
 - (c) Both the animal and its offspring will show the mutant trait.
 - (d) The animal but not its offspring can be affected by the mutation.
 - (e) Only the offspring and not the animal itself will show the mutant trait
3. Bread wheat has $6n = 42$ chromosomes. Bread wheat is
 - (a) haploid
 - (b) diploid
 - (c) tetraploid
 - (d) hexaploid
 - (e) heptaploid

4. An organism has the genotype Aa and the phenotype A . This means that A in relation to a is:
- (a) haploid.
 - (b) dominant.
 - (c) recessive.
 - (d) codominant.
 - (e) a hybrid.
5. The cross $AaBb \times AaBb$ is called a
- (a) dihybrid cross.
 - (b) backcross.
 - (c) reciprocal cross.
 - (d) testcross.
 - (e) monohybrid cross.
6. **XXX** can cause a single genotype to produce a range of potential phenotypes.
- (a) Epistasis
 - (b) The inbreeding coefficient
 - (c) Hybrid vigor
 - (d) Environmental effects
 - (e) Heritability
7. The multiple effects of a single gene on the phenotype are called
- (a) epistasis.
 - (b) pleiotropy.
 - (c) codominance.
 - (d) dihybrid.
 - (e) filial interactions.
8. A diploid species has a total of 52 chromosomes. How many chromosomes will you find in a monosomic, trisomic and autotriploid individual respectively?
- (a) 26, 53 and 104
 - (b) 51, 78 and 53
 - (c) 51, 53 and 78
 - (d) 51, 53 and 104
 - (e) 78, 51 and 53

9. A chromosome with a centrally located centromere is called
- (a) acrocentric.
 - (b) metacentric.
 - (c) submetacentric.
 - (d) subtelocentric.
 - (e) telocentric.
10. A fruit fly with a wild-type phenotype
- (a) has a dominant allele at each locus.
 - (b) has all recessive alleles.
 - (c) is homozygous.
 - (d) will not grow in the lab.
 - (e) none of these choices
11. Round, yellow peas are crossed with round, green peas and yield 3/4 round, yellow : 1/4 wrinkled, yellow. Which alleles are dominant?
- (a) wrinkled and green
 - (b) wrinkled and yellow
 - (c) round and green
 - (d) round and yellow
 - (e) can't be determined
12. In rabbits the agouti coat colour is dominant to Himalaya colour. From which of the following descriptions can you **not** infer the genotype for the locus completely
- (a) Agouti
 - (b) heterozygous
 - (c) Himalaya
 - (d) pure-breeding agouti
 - (e) More than one of the above.
13. Ability to roll the tongue is caused by a dominant allele. A woman is a “roller,” but one of her parents is not. What is the woman's genotype?
- (a) homozygous dominant
 - (b) homozygous recessive
 - (c) heterozygous
 - (d) either homozygous dominant or heterozygous
 - (e) cannot be determined from this information

14. Suppose that a diploid cell contains 6 chromosomes ($2n = 6$). How many different combinations in the gametes are possible?
- (a) 2
 - (b) 4
 - (c) 6
 - (d) 8
 - (e) 36
15. Red fruits (R) is dominant to yellow fruits (r), and hairy branches (HL) is dominant to hairless branches (hl) in tomatoes. A pure-breeding hairless plant with red fruits is crossed with a pure-breeding hairy plant with yellow fruits. What will the phenotype of the offspring be?
- (a) all hairy with red fruits
 - (b) all hairy with yellow fruits
 - (c) all hairless with red fruits
 - (d) all hairless with yellow fruits
 - (e) half hairless with yellow fruits, half hairy with red fruits
16. In a cross between pure-breeding purple tomatoes and pure-breeding green tomatoes, all of the F_1 are purple. When these plants are allowed to fertilize themselves, the F_2 plants occur in a ratio of 3 purple:1 green. Which of the following is **not** a valid conclusion from these results?
- (a) Fertilization occurs randomly between gametes carrying the purple and green alleles.
 - (b) The difference between purple and green colour in these lines is controlled by a single gene.
 - (c) The allele that produces the purple condition is dominant to the allele that produces the green condition.
 - (d) During production of gametes in F_1 plants, the purple and green alleles segregate from each other equally into the gametes.
 - (e) The purple and green alleles assort independently of each other in this cross.

17. The following recessive alleles are found in tomato: *r*, yellow fruits and *wf*, white flowers. A hybrid of unknown origin is testcrossed, with the following 1,000 progeny resulting: yellow fruits and flowers, 72; red fruits and white flowers, 76; red fruits and yellow flowers, 419; and yellow fruits and white flowers, 433. Which of the following could have been a parent of the dihybrid, assuming the parents were homozygous?
- (a) yellow fruits, white flowers
 - (b) red fruits, yellow flowers
 - (c) yellow fruits, yellow flowers
 - (d) red fruits, white flowers
 - (e) yellow fruits, white flowers or red fruits, yellow flowers
18. In humans, what blood types are possible among the offspring of a couple of blood types AB and A?
- (a) A and B only
 - (b) A and AB only
 - (c) A, B, and AB only
 - (d) A, B, and O only
 - (e) A, B, AB, and O
19. You self fertilize individuals (F_1) that are both the descendants of crosses between pure lines ($P_1 \times P_2$). The phenotypes of the offspring (F_2) segregate 2:1. Which conclusion is **not** correct?
- (a) The F_1 s are heterozygous
 - (b) A single gene affects the phenotype
 - (c) The gene causing the phenotype is lethal in homozygous form
 - (d) There are two different genotypes among the F_2 s
 - (e) All conclusions are correct
20. A tall parent and a short parent produce intermediate F_1 offspring that, when self-fertilized, produce a range of offspring heights, some taller than the tall P_1 and some shorter than the short P_1 . Which set of parental genotypes could account for these data?
- (a) $AABBCC \times aabbcc$
 - (b) $AABB \times aabb$
 - (c) $AABBcc \times aabbCC$
 - (d) $AA \times aa$
 - (e) $AA \times bb$

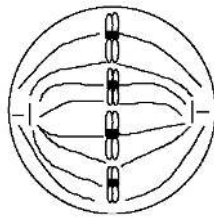
21. Assuming complete dominance and no linkage, what is the phenotypic ratio of the offspring of the cross $AaBb \times AaBb$?
- (a) 1:1
 - (b) 3:1
 - (c) 1:2:1
 - (d) 1:1:1:1
 - (e) 9:3:3:1
22. In 1892, the Swedish plant breeder Hans Tedin, made crossing experiments with peas. Tedin wanted to produce a new homogenous cultivar (all individuals identical), but had severe problems. Remember, this was eight years before the re-discovery of Mendel's laws. What should Tedin have done?
- (a) Repeatedly selected seeds from single individual plants.
 - (b) Only chosen plants with phenotypes of dominant traits.
 - (c) Alternated back crossing with the P_1 and P_2 plants.
 - (d) Multiplied all offspring in several generations and then selected seed from single plants.
 - (e) Hans could have used more than one strategy of the ones above.
23. In birds, males are homogametic. Cameo plumage (c) is recessive to the wild-type ($+$) and sex linked. A wild-type male is mated to a cameo female, and all the F_1 are wild-type. If these F_1 males are mated to F_1 females, what will be the ratio of wild-type to cameo females in the F_2 ?
- (a) 1:1
 - (b) 3:1
 - (c) 0:1
 - (d) 1:0
 - (e) 1:2
24. In a species 30 % of the nucleotides in the DNA is adenin (A). What percentage is expected to be guanin (G)?
- (a) 0.20
 - (b) 0.30
 - (c) 0.40
 - (d) 0.50
 - (e) 0.70

25. The gradual change of one species into another over time is called
- (a) cladogenesis.
 - (b) anagenesis.
 - (c) phylogenesis.
 - (d) punctuated evolution
 - (e) kin selection
26. Which agent of evolution tends to reduce genetic variation between populations and increase genetic variation within each population?
- (a) genetic drift
 - (b) migration
 - (c) inbreeding
 - (d) natural selection
 - (e) mutation
27. Which of the following does **not** bring about evolution in a population?
- (a) selection
 - (b) small population size
 - (c) mutation
 - (d) random mating
 - (e) migration of individuals from a population with a different genetic structure
28. On a remote island a population of rabbits of many different colours live. After a serious flooding only 10 % of the rabbits have survived. When you visit the island 10 years later the population size of the rabbits are back to what it was before the flood, but you can only find agouti and albino rabbits. The most likely reason for this is...
- (a) mutation.
 - (b) inbreeding depression.
 - (c) selection.
 - (d) bottleneck effect.
 - (e) founder effect.
29. How many tetrads are there in metaphase I of meiosis in human beings?
- (a) 2
 - (b) 22
 - (c) 23
 - (d) 46
 - (e) 92

30. A diploid somatic cell from a rat has a total of 42 chromosomes ($2n = 42$). As in humans, sex chromosomes determine sex: XX in females and XY in males. What is the total number of chromosomes in a polar body cell from a rat?

- (a) 21
- (b) 40
- (c) 41
- (d) 42
- (e) 84

31. Identify the stage of cell division and the diploid number of the cell in the figure below.



- (a) metaphase I of meiosis, $2n = 4$
- (b) metaphase I of meiosis, $2n = 8$
- (c) metaphase II of meiosis, $2n = 4$
- (d) metaphase of mitosis, $2n = 4$
- (e) none of these choices

32. During which mitotic phase do the sister chromatids separate and go towards opposite poles of the cell?

- (a) Interfas
- (b) Profas
- (c) Metafas
- (d) Anafas
- (e) Telofas

33. Use the following informations for question **33** - **35**.

Trihybrid F_1 individuals carrying recessive mutations at the loci A , B , and C are testcrossed, resulting in the following number of progeny of each given phenotype.

a	b	c	ab	ac	bc	abc	ABC
399	78	27	25	84	379	3	5

Which locus is in the middle of the three?

- (a) A
- (b) B
- (c) C
- (d) a
- (e) b

34. From the results, what is your best estimate of the $A - B$ distance, in map units?

- (a) 0.06
- (b) 0.21
- (c) 1
- (d) 6
- (e) 21.4

35. What is your best estimate of the $B - C$ distance, in map units?

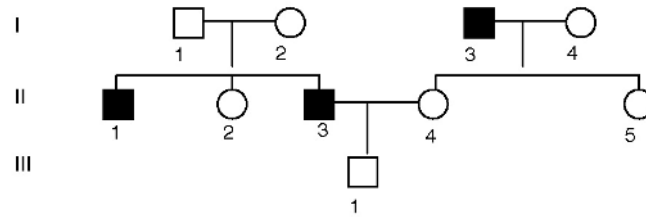
- (a) 0.21
- (b) 0.28
- (c) 0.8
- (d) 21.4
- (e) 27.5

36. Herbert Lamprecht crossed pure lines of peas with round seed and tendrils (shown in the figure) with peas with wrinkled seeds and no tendrils. The F_1 had round seeds and tendrils. Test crossing the F_1 produced an F_2 with the following phenotypes: 537 round seeds, with tendrils; 542 wrinkled seeds, without tendrils; 99 round seeds, without tendrils; 107 wrinkled seeds, with tendrils. What map distance did Herbert find between the two loci?

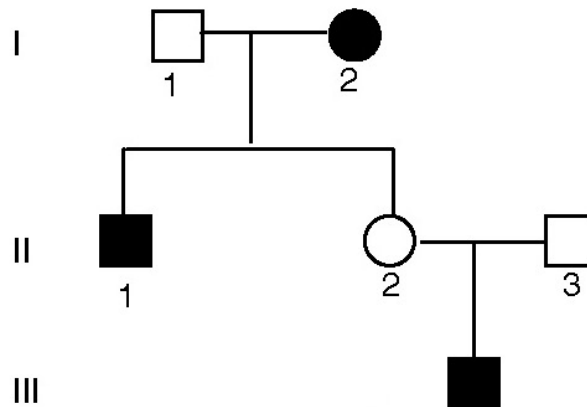


- (a) 0.16 cM
(b) 7.7 cM
(c) 8.3 cM
(d) 16.0 cM
(e) 18.4 cM
37. Red-green color blindness is X-linked recessive. A woman with normal color vision has a father who is color blind. The woman has a child with a man with normal color vision. Which phenotype is **not** expected?
- (a) a noncolor-blind female
(b) a noncolor-blind male
(c) a color-blind female
(d) a color-blind male
(e) all the above phenotypes are possible
38. A red-eyed female fly is crossed with a red-eyed male to produce all red-eyed females, 1/2 red-eyed males, and 1/2 white-eyed males. Which situation best describes the parental red-eyed female?
- (a) homozygous dominant for autosomal trait
(b) homozygous recessive for autosomal trait
(c) homozygous dominant for X-linked trait
(d) homozygous recessive for X-linked trait
(e) heterozygous for X-linked trait

39. Could the trait followed in the pedigree be caused by an X-linked recessive allele?



- (a) Yes, all individuals fit the X-linked recessive inheritance pattern.
 (b) No, the offspring of I-1 and I-2 contradict an X-linked recessive inheritance.
 (c) No, the offspring of I-3 and I-4 contradict an X-linked recessive inheritance.
 (d) No, the offspring of II-3 and II-4 contradict an X-linked recessive inheritance.
40. If the father and all his daughters but none of his sons have a genetic disease, how is the trait most likely inherited?
- (a) autosomal dominant
 (b) autosomal recessive
 (c) X-linked dominant
 (d) X-linked recessive
 (e) paternally
41. If the phenotype followed in the pedigree is autosomal recessive, then the genotype of I-1 is:



- (a) homozygous dominant.
 (b) heterozygous.
 (c) homozygous recessive.
 (d) hemizygous dominant.
 (e) hemizygous recessive.

42. Three genotypes occur in the following numbers: $AA = 25$, $Aa = 20$, $aa = 55$. Therefore, $p = f(A)$ is
- (a) 0.25.
 - (b) 0.35.
 - (c) 0.45.
 - (d) 0.50.
 - (e) 0.55.
43. For the Hardy-Weinberg equilibrium to hold exactly, population size should be
- (a) big.
 - (b) very big.
 - (c) very, very big.
 - (d) infinite.
 - (e) size does not come into play in this situation.
44. Suppose that in a rabbit population the frequency of the recessive Japanese brindling colour is $1/400$. Assume the presence of only a dominant allele (E^D) and a recessive allele (e^J) in the population and that the population is at Hardy-Weinberg equilibrium. What is the frequency of the recessive allele that causes the condition?
- (a) $1/1600$
 - (b) $1/400$
 - (c) $1/800$
 - (d) $1/40$
 - (e) $1/20$
45. If $p = f(A)$ and $q = f(a)$, then in a population in Hardy-Weinberg proportions
- (a) $f(AA) = p^2$ and $f(AA) = (1 - q)^2$.
 - (b) $f(AA) = p^2$ and $f(AA) = 1 - f(aa)$.
 - (c) $f(AA) = p^2$.
 - (d) $f(AA) = (1 - q)^2$.
 - (e) $f(AA) = 1 - f(aa)$.
46. The frequency of the I^A allele is 0.30 in southern Sweden while the frequency of I^B is 0.05. How many individuals with blood type AB do you expect in Malmö assuming that the population is in Hardy-Weinberg equilibrium.
- (a) 0.015
 - (b) 0.03
 - (c) 0.15
 - (d) 0.30
 - (e) 0.35

47. How can heritability be measured?
- (a) Compare individuals with different degrees of relatedness.
 - (b) Eliminate one of the variance components.
 - (c) Analyze regression observed from parents to offspring.
 - (d) All of the above methods can be used to measure heritability.
48. Total phenotypic variance can be decomposed into all but one of these components:
- (a) genetic–environment interaction variance.
 - (b) genetic variance.
 - (c) environmental variance.
 - (d) heritability.
49. The heritability for weight at 180 days in pigs is 0.3. In a given population the average weight was 90 kg. What average weight is to be expected from a sow weighing 95 kg at 180 days and a boar weighing 100 kg at the same age?
- (a) 92.25
 - (b) 90.04
 - (c) 95.00
 - (d) 97,01
 - (e) Cannot be calculated from the information
50. In tribbles, birth weight is heritable with no covariance (interaction) of environment and genotype. Average growth rate at three weeks of age is 0.4 lbs/day. At adulthood, breeders were chosen whose average three-week growth rates were 0.55 lbs/day. Their offspring had a mean three-week growth rate of 0.45 lbs/day. What is the narrow-sense heritability?
- (a) 0.55
 - (b) 0.50
 - (c) 0.45
 - (d) 0.40
 - (e) 0.33

Facit

1e

2d

3d

4b

5a

6d

7b

8c

9b

10e

11d

12a

13c

14d

15a

16e

17e

18c

19e

20c

21d

22e

23a

24a

25b

26b

27d

28d

29c

30a

31d

32d

33a

34d

35d

36d

37c

38e

39a

40c

41b

42b

43d

44e

45a

46b

47d

48d

49a

50e