Tentamen, Genetik (NBIA24, 91BI11, 91BI17, 92BI11, 92BI17 och TFBI11), 21/4 2014

Sist i häftet hittar du svarsblanketten. Fyll i rätt svar på denna och lämna in. Om du vill kan du behålla frågehäftet.

LYCKA TILL!

1. Genes come in different versions called:
   (a) alleles.
   (b) loci.
   (c) genotypes.
   (d) chromosomes.
   (e) genomes.

2. Which of the following statements about dominance is **not** true
   (a) A dominant allele is the most common one in a population
   (b) An individual expressing a dominant trait will always have at least one parent also expressing it
   (c) A trait caused by a dominant allele is always expressed
   (d) An individual expressing a dominant trait can be heterozygous
   (e) An individual expressing a dominant trait can have offspring not expressing it

3. Oats has 6n = 42 chromosomes. Oats is
   (a) haploid
   (b) diploid
   (c) triploid
   (d) tetraploid
   (e) hexaploid

4. A **xxx** mutation changes a codon that specifies an amino acid into one that terminates translation.
   (a) missense
   (b) nonsense
   (c) silent
   (d) neutral
   (e) reverse

5. The cross $AaBb \times aabb$ is called a

   (a) dihybrid cross.
   (b) backcross.
   (c) reciprocal cross.
   (d) testcross.
   (e) monohybrid cross.

6. The interaction of nonallelic genes in forming the phenotype is called

   (a) epistasis.
   (b) pleiotropy.
   (c) codominance.
   (d) dihybrid.
   (e) filial interactions.

7. A chromosome with a centrally located centromere is called

   (a) metacentric.
   (b) telocentric.
   (c) acrocentric.
   (d) submetacentric.
   (e) subtelocentric.

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) 51, 78 and 53
   (b) 26, 53 and 104
   (c) 78, 51 and 53
   (d) 51, 53 and 78
   (e) 51, 53 and 104

9. Round, yellow peas are crossed with round, green peas and yield 3/4 round, yellow : 1/4 wrinkled, yellow. Which alleles are dominant?

   (a) round and yellow
   (b) wrinkled and green
   (c) wrinkled and yellow
   (d) round and green
   (e) can't be determined

10. In horses, the coat colour grey is dominant to the colour brown. From which of the following descriptions can you **not** infer the genotype for the locus completely?

    (a) Grey

    (b) Brown

    (c) Pure-breeding grey

    (d) heterozygous

    (e) More than one of the above.

11. In humans, B can **not** refer to

    (a) An allele at the locus for eye colour

    (b) The eye colour phenotype of an individual

    (c) The eye colour genotype of an individual

    (d) The eye colour genotype of a gamete

    (e) More than one of the above.

12. Suppose that a diploid cell contains 6 chromosomes ($2n = 6$). How many different combinations in the gametes are possible?

    (a) 2

    (b) 4

    (c) 8

    (d) 16

    (e) 64

13. A woman of blood type B has a type A child. A man of which blood type could have been the father?

    (a) A

    (b) B

    (c) AB

    (d) O

    (e) A or AB

14. Full pod shape (F) is dominant to constricted pod shape (f), and yellow pod color (Y) is dominant to green pod color (y) in pea plants. A pure-breeding green plant with full pods is crossed with a pure-breeding yellow plant with constricted pods. The offspring are then test crossed. What is the expected phenotypic ratio of the offspring from the test cross?

    (a) 1:2:1

    (b) 3:1

    (c) 1:1:1:1

    (d) 9:3:3:1

    (e) 9:7

15. Agouti colour in mice is caused by a dominant allele. A female mouse is agouti but one of ther parents is black. The mouse is pregnant with a black male mouse. What proportion of the offspring is expected to be agouti?

    (a) 1/4

    (b) 1/3

    (c) 3/4

    (d) 1/2

    (e) 2/3

16. If a male butterfly that is heterozygous for a recessive Z-linked mutation is crossed to a wild type female, what proportion of the progeny will be mutant males?

    (a) 0 %

    (b) 100 %

    (c) 75 %

    (d) 50 %

    (e) 25 %

17. A certain type of haemophilia is X-linked recessive. A non-haemophiliac woman has a haemophiliac father. The woman has a child with a non-haemophiliac man. Which phenotype is **not** expected?

    (a) a haemophiliac female

    (b) a haemophiliac male

    (c) a non-haemophiliac female

    (d) a non-haemophiliac male

    (e) more than one of the above

18. White eye is a recessive X-linked mutant in *Drosophila melanogaster*. A wild-type male is mated to a white-eyed female. What is the probability that an F_1 son will be white-eyed?

    (a) 0

    (b) 0.25

    (c) 0.5

    (d) 0.75

    (e) 1.0

19. Full pod shape (F) is dominant to constricted pod shape (f), and yellow pod color (Y) is dominant to green pod color (y) in pea plants. A pure-breeding green plant with full pods is crossed with a pure-breeding yellow plant with constricted pods. What will be the phenotype of the offspring?

    (a) all green with a full pod

    (b) all yellow with a constricted pod

    (c) all yellow with a full pod

    (d) all green with a constricted pod

    (e) half green with a constricted pod, half yellow with a full pod

20. In a species 30 % of the nucleotides in the DNA is adenin (A). What proportion is expected to be guanin (G)?

    (a) 0.10

    (b) 0.20

    (c) 0.30

    (d) 0.40

    (e) 0.70

21. Speciation that occurs by the origin of a polymorphism in the midst of the species range is called

    (a) sympatric.

    (b) parapatric.

    (c) allopatric.

    (d) punctuated.

    (e) phyletic.

22. A woman whose husband worked at the Chernobyl nuclear reactor gives birth to a hemophilic son.

    (a) She should blame the reactor accident because the radiation might have caused the hemophilia.

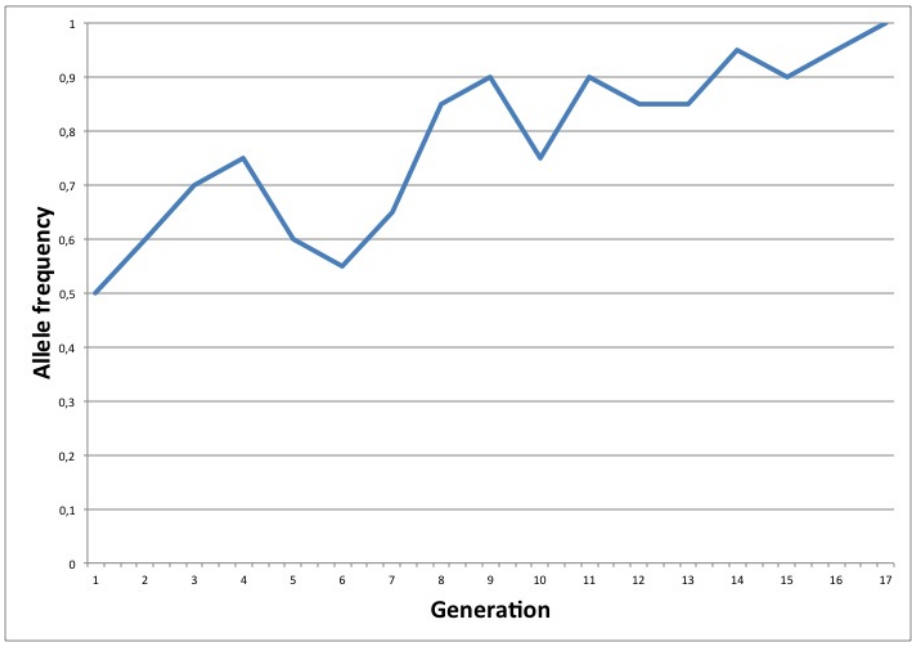
    (b) She should not blame the accident because she may have carried the hemophilia allele.

    (c) Her husband should sue for divorce because it can't be his child.

    (d) Further genetic tests should be done to determine who is at fault.

    (e) Hemophilia is environmentally induced, not genetic.

23. Which agent of evolution is most likely responsible for the change in allele frequency shown in the graph below?



    (a) mutation

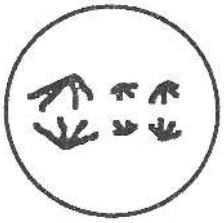
    (b) genetic drift

    (c) selection

    (d) assortative mating

    (e) inbreeding

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



(a) anaphase of mitosis 2n = 6

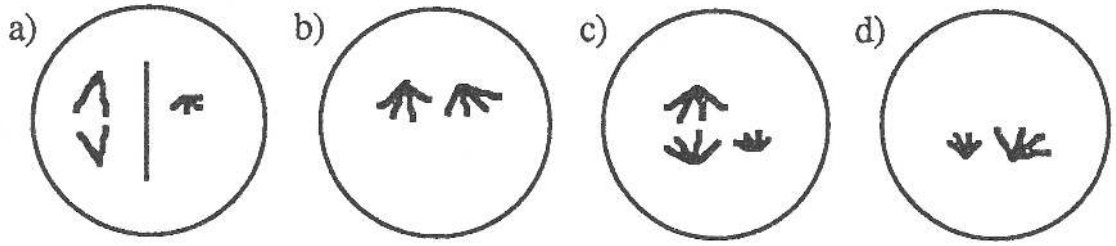
(b) anaphase I of meiosis, 2n = 6

(c) anaphase II of meiosis, 2n = 6

(d) anaphase I of meiosis, 2n = 12

(e) anaphase II of meiosis, 2n = 12

25. The figures below show cells in meiotic metaphase I or II with sex chromosomal nondisjunction. Only the sex chromosomes are shown and the Y chromosome is the smaller. In which of the cells is XXY **not** a possible outcome



(e) XXY is possible from all cells

26. How many tetrads are there in metaphase I of meiosis in *Arabidopsis thaliana* (2n = 10)?

(a) 5

(b) 10

(c) 15

(d) 20

(e) 40

27. Crossing over occurs during:

(a) interphase.

(b) prophase.

(c) metaphase.

(d) anaphase.

(e) telophase.

28. Use the following informations for question **28 - 30**.

Trihybrid F_1 *Arabidopsis* carrying mutations for hairlessness (*gl-1*), yellow plants (*ch1*), and early flowering (*fri*) are testcrossed. The progeny have the following phenotypes

wild type	5	hairless	399
yellow	78	early	27
hairless, yellow	25	hairless, early	84
yellow, early	379	hairless, yellow, early	3

From the results, what is your best estimate of the yellow - early flowering distance, in map units?

(a) 6

(b) 16.2

(c) 17

(d) 21.4

(e) 23

29. Which gene is in the middle on the chromosome?

(a) hairless

(b) yellow

(c) early

(d) none, only two genes linked

(e) none, all genes are unlinked

30. What is your best estimate of the yellow - hairless distance, in map units?

(a) 6

(b) 16.2

(c) 17

(d) 21.4

(e) 23

31. What is the sex chromosome constitution of a male duck-billed platypus?

(a) XX

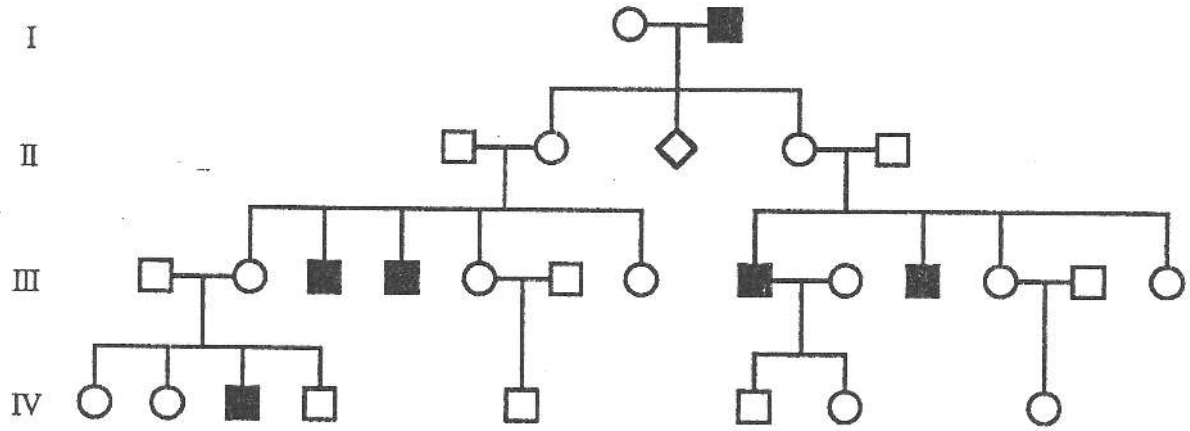
(b) XY

(c) XO

(d) ZZ

(e) XXXXXYYYYY

32. Use the pedigree below for question **32 - 34**.



Which mode of inheritance is the most likely one for the trait shown in the pedigree?

(a) Autosomal dominant

(b) Autosomal recessive

(c) X-linked dominant

(d) X-linked recessive

(e) Y-linked

33. Which mode of inheritance is *not* possible?

(a) Neither type of autosomal inheritance is possible.

(b) Neither type of X-linked inheritance is possible.

(c) Neither type of dominant inheritance is possible.

(d) Neither type of recessive inheritance is possible.

(e) Only Y-linked is not possible.

34. Numbering the individuals of each generation from left to right, and using A and a for autosomal alleles and X and x for X-linked alleles respectively, what is the genotype of individual II:2?

(a) AA

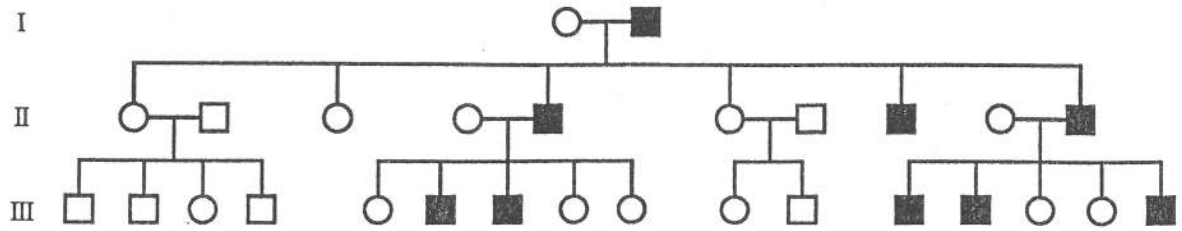
(b) Aa

(c) aa

(d) XX

(e) Xx

35. Which mode of inheritance is the most likely one for the trait shown in the pedigree?



(a) Autosomal dominant

(b) Autosomal recessive

(c) X-linked dominant

(d) X-linked recessive

(e) Y-linked

36. The blue colour in Andalusian chicken is controlled by a singe autosomal codominant gene with the alleles Bl_1 and Bl_2, where Bl_1 homozygotes are white and Bl_2 homozygotes are black. What is the frequency of the Bl_1 allele in a population consisting of 56 white, 28 blue and 16 black chicken respectively?

(a) 0.28

(b) 0.3

(c) 0.56

(d) 0.7

(e) 0.84

37. Approximately one child in 10,000 is born with the recessive trait PKU. Assuming Hardy-Weinberg equilibrium, about what percentage of the population is made up of non-affected carriers?

(a) less than 1 %

(b) 1.4 %

(c) 2.0 %

(d) 2.7 %

(e) 5.0 %

38. For the Hardy-Weinberg equilibrium to hold exactly, population size must be

(a) big.

(b) very big.

(c) very, very big.

(d) infinite.

(e) size does not come into play in this situation.

39. In a population fulfilling all the assumptions of the Hardy-Weinberg equilibrium, allelic frequencies

    (a) will not change from generation to generation.

    (b) change randomly from year to year.

    (c) change infinitesimally from year to year.

    (d) change only in females from year to year.

    (e) change only in males from year to year.

40. If there are two alleles, A and a, in a population and the population is at Hardy-Weinberg equilibrium, which frequency of A would produce the greatest frequency of heterozygotes?

    (a) 0.1

    (b) 0.25

    (c) 0.5

    (d) 0.75

    (e) 1

41. 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) 0.33

    (b) 0.40

    (c) 0.45

    (d) 0.50

    (e) 0.55

42. 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 among the offspring of 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

43. Question 43 - 50 are based on a 2014 study by Kadri *et al.*

    In Danish, Swedish and Finnish Red Cattle a 660 kb stretch of DNA has been lost compared to all other cattle breeds. This is called a(n)

    (a) inversion.
    (b) insertion.
    (c) deletion.
    (d) indel.
    (e) translocation.

44. The allele that has the 660 kb is called the **XXX** allele

    (a) original
    (b) mutant
    (c) wildtype
    (d) correct
    (e) other

45. Embryos homozygous for not having the 660 kb piece of DNA never develops. The allele lacking the fragment is called

    (a) dominant.
    (b) incompletely dominant.
    (c) codominant.
    (d) selected.
    (e) lethal.

46. What is the fitness of embryos described above?

    (a) 0
    (b) 0.5
    (c) 1
    (d) s
    (e) 100%

47. Bulls heterozygous for the missing fragment are mated with heterozygous cows. Which genotypic ratio is expected among the offspring at birth?

    (a) 1:1
    (b) 1:2
    (c) 1:3
    (d) 1:2:1
    (e) 15:1

48. The allele lacking the 660 kb has a positive effect on milk yield and occurs at approximately 30 % in Danish, Swedish and Finnish Red Cattle. What type of selection is acting on the region?

    (a) positive selection

    (b) negative selection

    (c) frequency dependent selection

    (d) balancing selection

    (e) sexual selection

49. Which of the following best describes how selection is acting on the three genotypes A_1A_1, A_1A_2 and A_2A_2, if A_1 is the allele lacking the 660 kb?

    (a) 1-s, 1, 1-t

    (b) 1, 1, 1-s

    (c) 1, 1-s, 1-s

    (d) 1-s, 1-s, 1

    (e) 1-s, 1, 1-s

50. At birth the genotype frequencies compared to Hardy-Weinberg equilibrium will be

    (a) the same.

    (b) higher for homozygotes of both types.

    (c) higher for homozygotes of the allele without the 660 kb.

    (d) higher for heterozygotes.

    (e) zero for homozygotes.

Facit

1. A
2. A (C can also be incorrect if epistasis occurs)
3. E
4. B
5. D
6. A
7. A
8. D
9. A
10. A
11. C
12. C
13. E
14. C
15. D
16. A
17. A
18. E
19. C
20. B
21. A
22. B
23. B
24. B
25. A
26. A
27. B
28. D

29. A
30. A
31. E
32. D
33. C
34. E (B possible but less likely)
35. E
36. D
37. C
38. D
39. A
40. C
41. A
42. A
43. C
44. C
45. E
46. A
47. B
48. D
49. A
50. D