DEC-2023

1. Some of the statements given below are related to species that show r- or k-selection strategies:
   A. Maximum rate of increase of a population
   B. Density of individuals supported by the environment at equilibrium.
   C. Life history evolution
   D. Liebig's law of the minimum
   E. Precociality and altriciality
   Choose the option that contains all the correct statements related to r- and k-selection strategies.
   a) A and B only
   b) A, B and C only
   c) C, D, and E only
   d) A, B, C and E only

2. 1Western Ghats of India is considered as one of the global biodiversity hotspots because of some of the following characteristics:
   A. High species richness
   B. High endemism
   C. Habitat loss
   D. Large altitudinal range
   Which one of the following options represents the correct combination of characteristics that qualifies the Western Ghats as a biodiversity hotspot?
   a) A, B and C
   b) A, C and D
   c) A and B only
   d) B and D only

3. The table below lists terminologies (column X) and concepts (column Y) related to ecological niche.

	Column X		Column Y
A	Niche complementarity	i	Species distribution explained by trophic levels and biotic interactions.
B	Niche packing	ii	Tendency for coexisting species which occupy a similar position along at least one niche dimension.
C	Community niche	iii	Tendency for coexisting species to fill the available space along important niche dimensions.
D	Eltonian niche	iv	Composition of niches of all individual species niches that co-occur at the same site.

   Which one of the following options represents the correct match between column X and column Y?
   a) A-i B-ii C-iii D-iv
   b) A-iii B-i C-ii D-iv
   c) A-ii B-iii C-iv D-i
   d) A-ii B-iii C-iv D-iII

4. Given below are statements related to different types of natural selection models.

   A. Directional selection changes the average value of a trait.
   B. Stabilizing selection increases variation in a trait.
   C. Disruptive selection reduces variation in a trait.
   D. Balancing selection maintains variation in a trait.
   Select the correct option that represents the combinations of statements that are NOT true about natural selection.
   a) A and B
   b) B and C

c) C and D
d) A and C

5. 2In a study comparing different plant communities (A to D) across a landscape, the following data were obtained:

Community	A	B	C	D
No. of species in the community	12	25	11	19
No. of species common to both communities				
Community	A	B	C	D
A		9	8	10
B			6	14
C				7
D				

Which one of the following options represents the pair of communities with highest similarity value when Sorenson's coefficient is used?
a) A and C
b) A and D
c) B and C
d) B and D

6. Consider a highly diverse community of closely related species of lizards which has evolved in a short period of time and that occupies different ecological niches in peninsular India. What type of speciation process can
a) Non-ecological speciation
b) Adaptive radiation
c) Allopatric speciation
d) Parapatric speciation

JUN-2023

1. A tree species has leaves that contain an allelochemical compound that leaches into the soil and prevents the growth of its own seedlings. What kind of dispersion pattern is likely as a result of this process in the adult population of this species?
a) Random
b) Clumped
c) Uniform
d) Bimodal

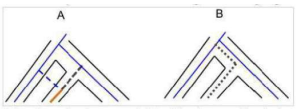
2. Which one of the following methods is NOT useful for sampling pteridophytes to study their distribution patterns?
a) Ad libitum sampling
b) Quadrat sampling
c) Belt transect sampling
d) Random sampling

3. Reduction in the frequency of heterozygous genotype with a concomitant increase in the frequency of homozygous genotype, in context of random mating is due to :
a) Genetic drift
b) Intense inbreeding
c) Reverse mutation
d) Founder effect

4. Which one of the options given below is NOT desirable when setting up nature reserves in the tropics?
    a) Reserves that are linked to each other by corridors
    b) Reserves that are surrounded by a buffer zone of same ecosystem
    c) High edge-to-area ratio of the reserve
    d) Circular shaped reserve

5. Which one of the following options lists mechanisms that drive ecological succession?
    a) Only facilitation and tolerance
    b) Disturbance and tolerance
    c) Only tolerance and inhibition
    d) Facilitation, tolerance and inhibition

6. The two phylogenetic trees given below represent evolutionary patterns in species or population. The differently colored or dashed lines represent a single species or gene genealogy.



Select the option that correctly identifies the type of evolutionary process that these two figures represent.
    a) A- hybridization, B - incomplete lineage sorting
    b) A- convergence, B - incomplete lineage sorting
    c) A- adaptive introgression, B - hybridization
    d) A- hybridization, B-adaptive introgression

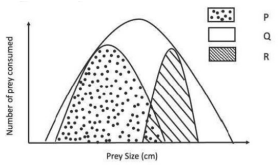
7. You are sampling birds in a forest community to determine species diversity of birds in this region. How would you assess the sampling effort to ensure that you have obtained a reasonable estimate of the diversity in the region?
    a) Based on the species accumulation curve.
    b) You cannot determine this, as sampling effort and species richness are independent of one another.
    c) Based on the calculation of Morisita-Horn similarity index.
    d) Based on the calculation of Simpson's diversity index.

8. The number of individuals of different species in two communities P and Q is given below.

Species	P	Q
A	59	21
B	12	20
C	44	23
D	20	12
E	11	19
F	10	14
G	2	1
H	5	13
I	3	13
J	30	12

Based on the given data select the correct statement.
    a) Community P has higher species diversity than Q.
    b) Community Q has higher species diversity than P.
    c) Both communities P and Q are equally diverse.
    d) Data is not sufficient to compute species diversity.

9. The figure below represents the fundamental and realised niche of two species.



Which one of the following options correctly identifies the fundamental niche and realised niche of any one of the species?

a) Fundamental niche - P; Realised niche- Q
b) Fundamental niche - Q; Realised niche- P
c) Fundamental niche - P; Realised niche - R
d) Fundamental niche - R; Realised niche - P

10. The theory of island biogeography has synthesized into theory the following concepts, except:
    a) Competition
    b) Immigration
    c) Equilibrium
    d) Speciation

11. Directional Selection for a particular trait will lead to the frequency of the trait:
    a) being normally distributed in the population.
    b) always showing a left-skewed distribution in the population.
    c) always showing a right-skewed distribution in the population.
    d) showing either a right- or a left-skewed distribution in the population.

12. The following terms represent different methods in phylogenetic tree constructions
    A. Unweighted Pair Group Method Using Arithmetic Average (UPGMA)
    B. Minimum Evolution (ME) method
    C. Maximum Parsimony (MP) method
    D. Maximum Likelihood (ML) method
    Select the option that represents all distance-based methods?
    a) A and B
    b) B and C
    c) C and D
    d) A and D

13. Invasive species, in general grow very well in a new area that they invade, and often outcompete native species. An explanation for the better growth and propagation of invasive species in comparison to their native counterparts is provided by which one of the following hypotheses.
    a) Ecological niche hypothesis
    b) Intermediate disturbance hypothesis
    c) Enemy release hypothesis
    d) Biotic resistance hypothesis

14. Which one of the following methods is best suited to estimate the population size of fish?
    a) Camera Trap
    b) Line Transect
    c) Point count
    d) Mark-Recapture

15. Which one of the following statements is correct for a primary successional species?

a) These species do not follow specific survivorship curves.
b) These species show Type II survivorship curve.
c) These species show Type III survivorship curve.
d) These species show Type I survivorship curve.

16. A positive association between absolute average individual fitness and population size over some finite interval is known as
    a) Allee effect
    b) Founder effect
    c) Rensch 's rule
    d) Bergmann's rule

17. Which one of the following terms is used for species that exploit the same resources in a similar manner?
    a) Guild
    b) Taxonomic order
    c) Community
    d) Assemblage

18. The relationship between species and area of distribution is given by the following equation: $S=CA^z$ where S is the number of species on an island or isolated patch, A is the area of the habitat, and C and Z are constants. The following are a set of statements pertaining to the value of 'Z':
    A. Z value is typically not greater than 0.4 across all ecosystem types.
    B. Z value is positively related to a species' dispersal capability, with flying and wind-dispersed organisms having the highest values.
    C. Z value, which represents the slope in the relationship, declines with area, especially when large landmasses such as continents are considered.
    D. The Z value is the exponent in the power model and can be used to estimate the proportion of area required to represent a given promotion of species present in any land class.
    Select the option that represents the combination of all correct statements.
    a) A and B
    b) A and D
    c) B and C
    d) C and D

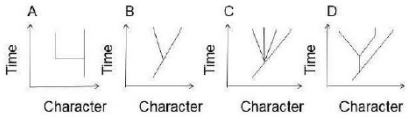
19. Given below are a set of statements about metapopulation dynamics and habitat
    A. The sizes of suitable patches are important because demographic stochasticity can lead to extinction, especially in organisms with low reproductive output.
    B. In the incidence function model (IFM), the extinction risk of local
    populations increase with increasing habitat patch area, and the colonization probability is a function of patch isolation from existing local populations.
    C. From the conservation perspective, large numbers of suitable patches are not sufficient if distances are too large, preventing recolonization and the rescue etiect.
    D. To minimize extinction risk there should be as low a variance in local patch quality as possible, to allow for synchronous dynamics. Which one of the following
    options represent the combination of all correct statements.
    a) A and C
    b) B and C
    c) A and D
    d) B and D

20. A scientist is using the Hardy-Weinberg equation to assess if a population is in equilibrium or is evolving. She recorded the following characteristics for this population:
    A. The size of the population is very large.
    B. Individuals are randomly mating.

C. Individuals are under natural selection.
D. New alleles are added to the population through migration and dispersal.
E. Mutation rates are high. Which one of the following options contains all INCORRECT characteristics of a population in Hardy-Weinberg equilibrium?

a) A and D
b) C, D and E
c) A, B and C
d) B and E

21. The following trees represent different evolutionary mechanisms.



Select the tree which best represents punctuated equilibrium.

a) A
b) B
c) C
d) D

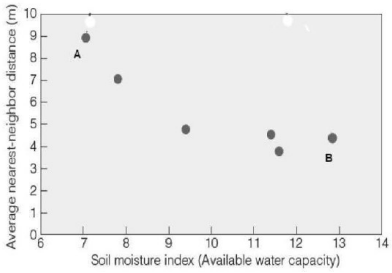
22. Four different plant communities that consisted of the same number of species were taken up for a species diversity study. The following table represents some of the outcomes:

Community	Simpson's Reciprocal Index Value
A	7.25
B	8.20
C	6.80
D	7.05

Select the correct statement about the evem1ess of the above communities.

a) The evem1ess of all the four communities is the same.
b) B > A > D > C represents the decreasing order in evenness of the communities.
c) C > D > A > B represents the decreasing order in evenness of the communities.
d) Using the given information, we cannot compare the evenness of the communities.

23. Ecologists examined the role of competition for below ground resources (water and nutrients) in the dispersion pattern of trees in the Acacia savannas of South Africa. The figure below depicts the result of their study.



In case all the other parameters were constant, select the option that best represents the dispersion patterns for populations labelled A and B in the figure above.

a) A-Regular and B-Random
b) A-Random and B-Clumped
c) A-Clumped and B-Regular
d) A-Regular and B-Regular

24. A food chain involving Spartina (a plant), the marsh periwinkle snail, the blue crab and an unknown fungus was identified in a Spartina-dominated salt marsh in North America. A study involving control and crab-exclusion experiments revealed:
A. Radulations (scrape marks) on the leaf surface made by the snails indicate the presence of snail faeces, fungi and dead plant tissue.
B. The fungi were present only at the radulations.
C. The density of the radulations increased with higher snail densities.
D. Spartina density decreased with increase in the snail density till it reached zero.
E. In control experiments, all four species were present till the end.
Select the option that correctly depicts the positive (+) and negative (-) interaction-type between fungi- snail and Spartina-crab, respectively:
    a) - and+
    b) and-
    c) +and-
    d) +and+