

# M.Sc Wildlife Biology and Conservation

## National Entrance Test, December 13, 2015

All questions in Sections 1, 2 and 3 are multiple choice questions. Each question has only one correct or best answer. All questions carry one mark. There is no negative marking. There are a total of 80 questions.

The question in Section 4 is an essay type question. The essay carries 20 marks. There are some more detailed instructions on answering this section at the start of Section 4.

### SECTION 1

1. In the following sentence, there are four words that are underlined, one of which must be changed for the sentence to be grammatically correct. Which word is it?

Despite the teacher's repeated requests, none of her students were willing to help her clean up the classroom.

- a) Despite
- b) repeated
- c) were ✓
- d) her

2. Which of the following sentences is best constructed and has no redundancies?

- a) Always, whenever it rained heavily, the streets of the city flooded.
- b) The streets of the city always flooded whenever it rained heavily.
- c) When it rained heavily, always the streets of the city flooded.
- d) Whenever it rained heavily, the streets of the city flooded. ✓

3. Which of the following sentences has the most correct construction in terms of tenses?

- a) In the future, the present will be the past. ✓
- b) In the future, the present shall be the past.
- c) In the future, the present would be the past.
- d) In the future, the present can be the past.

4. From among the following, choose the word that is most accurately the opposite in meaning to the word "debacle"

- a) disaster
- b) spectacle
- c) gain
- d) success ✓

5. From among the following, select the pair of words that expresses a relationship most similar to that between mother and child

- a) Horse and pony
- b) Cow and calf ✓
- c) Adult and Juvenile
- d) Frog and Tadpole

6. Five horses ran in a race. Deccan Queen finished after Jhansi. Deccan Queen came in ahead of Annapoorna. Plateau King beat Jhansi but finished after Rani Thema. Where did Plateau King and Deccan Queen finish?

- a) 1<sup>st</sup> and 3<sup>rd</sup>
- b) 2<sup>nd</sup> and 4<sup>th</sup> ✓
- c) 3<sup>rd</sup> and 5<sup>th</sup>
- d) 4<sup>th</sup> and 5<sup>th</sup>

7. Shreya is double the age of Norgei and one third as old as Deepak who will be 44 years old in 8 years. How old is Norgei?

- a) 6 ✓
- b) 12
- c) 36
- d) 24

8. I have 24 cricket balls. I give you 8 of them. You now have twice the number of cricket balls that I do. How many cricket balls did you have to begin with?

- a) 8
- b) 16
- c) 24 ✓
- d) 32

9. You are standing facing North. You walk 20 meters and then turn 90 degrees clockwise. You then walk another 10 meters and then turn 45 degrees anticlockwise. You now walk 15 meters and then turn 135 degrees clockwise and walk another 5 meters. In which direction are you now facing?

- a) North
- b) South ✓
- c) East
- d) West

10. All the trees in the park are flowering. Some of the trees in the park are Gulmohar trees. There are also some Cassia trees in the park. Which of the following is correct?

- a) Some Cassia and all Gulmohar trees in the park are flowering.
- b) Some Gulmohar and all Cassia trees in the park are flowering.
- c) All Gulmohar trees in the park are flowering. ✓
- d) Some Gulmohar and some Cassia trees in the park are flowering.

## SECTION 2

In a triathlon, athletes compete in a three stage race which starts with swimming for 1.5 km followed by cycling for 40 km and followed by running for 10 km. The following table contains the timings (in minutes) of four athletes for each stage of a triathlon. Answer the following three questions using the information in the table below:

	Swimming	Cycling	Running
A	19	75	44
B	22	74	46
C	21	70	41
D	25	65	43

11. What was the order (from first to last) of the four athletes at the end of the cycling stage?

- a) A, B, C, D
- b) B, A, C, D
- c) D, C, A, B ✓
- d) C, A, D, B

12. Do the timings in any one stage perfectly predict the final result of the race? Choose from among the following:

- a) Cycling
- b) Running ✓
- c) Swimming
- d) None

13. What are the minimum number of overtakings that must have taken place in the running stage?

- a) 0
- b) 1 ✓
- c) 2
- d) 3

14. What is the x-value where the quadratic function  $3 + 5x - 0.5x^2$  reaches its maximum?

- a) 3
- b) 5 ✓
- c) 4.5
- d) 2.5

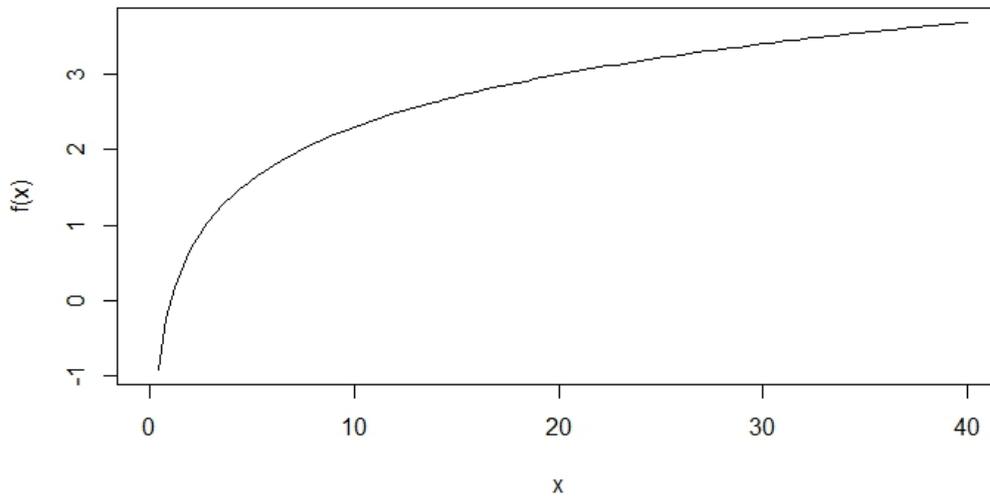
15. A fair coin (which gives *heads* and *tails* with equal probability) is tossed into the air 9 times. In all of the nine instances, the coin lands with the head facing up. What is the probability that the 10<sup>th</sup> coin toss will also land with the head facing up?

- a)  $(1/2)^9$
- b) 0
- c)  $(1/2)$  ✓
- d) 1

16. You want to colour-band crows for a behavioural study such that each individual should be uniquely identifiable. You have bands of the following colours: red, green, blue, yellow and black. You place two colour bands on a single leg of the crow (left or right), one above the other. The other leg of that crow receives no band. After the bird has been released, you can see which leg the bands are on, as well as separately note the colour of the band above and that below. With this protocol, how many individual crows can you mark with a unique combination?

- a) 5
- b) 25
- c) 50 ✓
- d) 100

17. Which is the one function that the plot below can NOT possibly depict? Note:  $a$  and  $b$  are constants,  $\log_e$  is the natural logarithm.



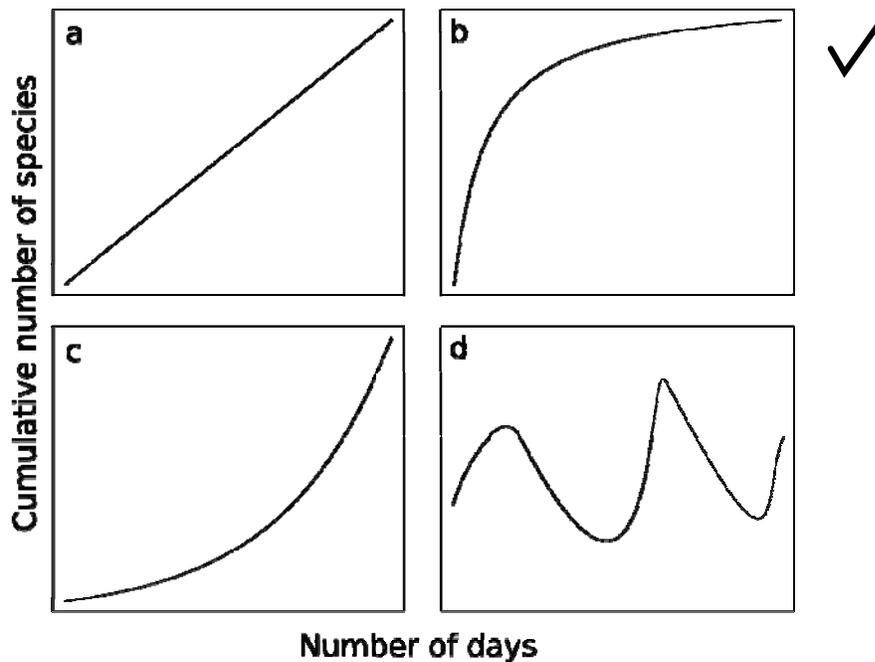
- a)  $f(x) = \log_e(x)$
- b)  $f(x) = \frac{1}{x}$  ✓
- c)  $f(x) = \frac{ax}{b+x}$
- d)  $f(x) = ax^b$ , where  $0 < b < 1$

18. An unknown number of guppies *Poecilia reticulata* were released into the pond behind the NCBS cafeteria in 2013. Based on previous studies we know that population growth of the species can be described by the geometric growth model (at least for the initial few years):  $N_t = \lambda^t N_0$ , where  $N_t$  is population size at year  $t$  (e.g.  $N_3$  is population size at year 3),  $N_0$  is the initial population size at year 0,  $\lambda$  is the finite rate of increase (the ratio of population sizes for two successive years  $N_{t+1}/N_t$ ). Previous research also tells us that the finite rate of increase for the species  $\lambda$  is 1.1. If the population size  $N_2$  in 2015 is estimated to be 242 individuals, what was  $N_0$ , the number of individuals initially released into the pond in 2013?

- a) 147
- b) 240
- c) 200 ✓
- d) 220

19. You are doing a butterfly survey in a sanctuary, recording species as you come across them. As you spend more time, you plot the total (cumulative) number of species against the number of days you have spent in the field. What do you expect this graph to look like?

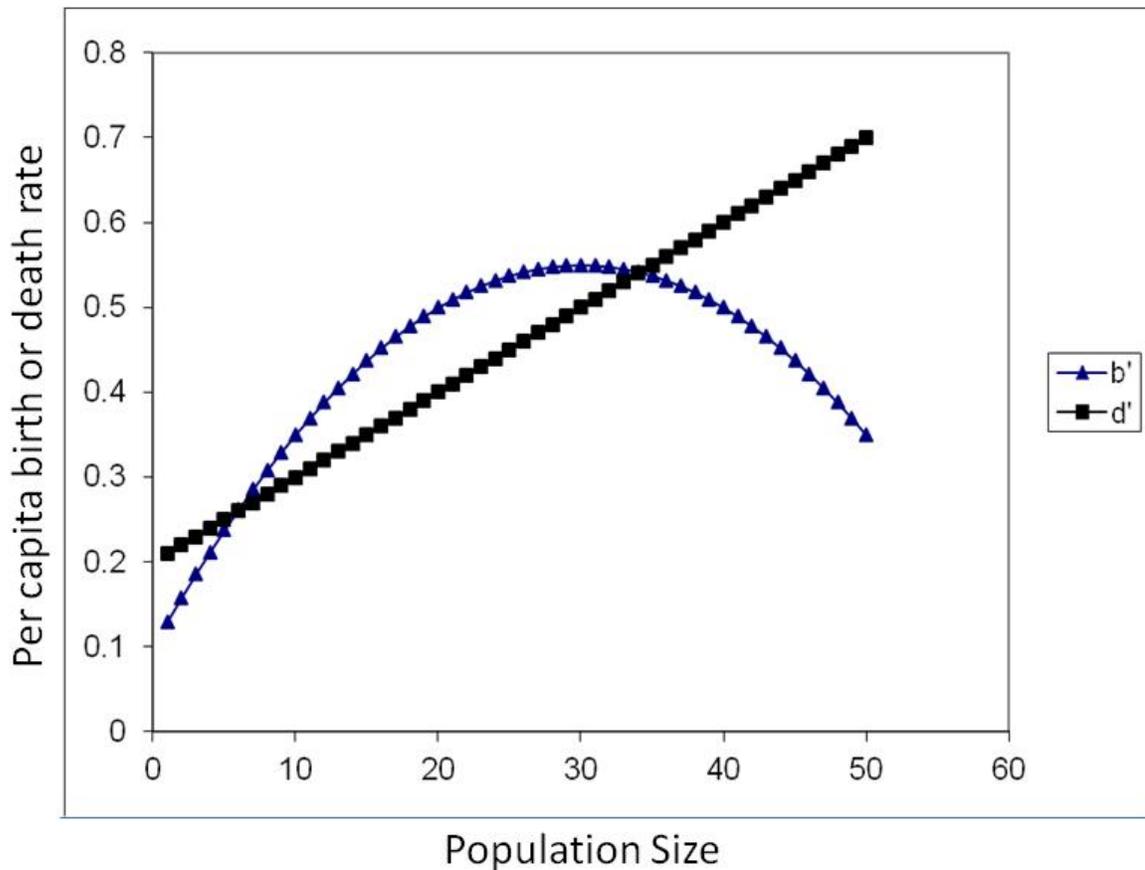
Choose a, b, c or d from the following graphs:



20. For a unimodal distribution, if the median < mean

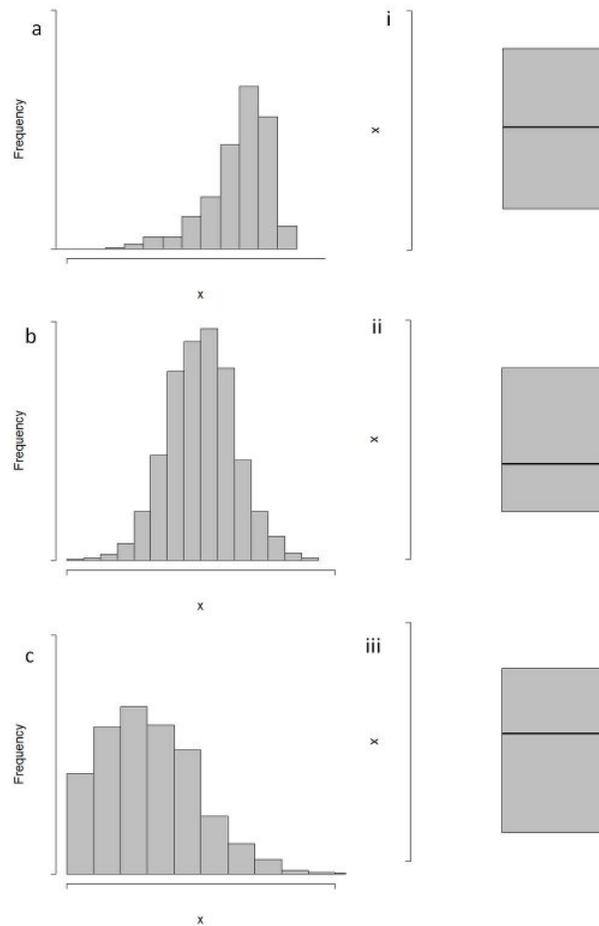
- a) The distribution has a long right tail ✓
- b) The distribution has a long left tail
- c) The distribution is perfectly Gaussian
- d) The mode must be more than the median

21. Per capita birth (births/individual/unit time) and death (deaths/individual/unit time) rates of the Nilgiri marten *Martes gwatkinsii* in Brahmagiris WLS are density dependent, which is to say that values of these two rates vary depending on population size. The plot below shows that per capita death rate  $d'$  (squares) increases linearly with population size, while per capita birth rate  $b'$  (triangles) increases initially, and then declines when population size exceeds about 30 individuals. Keep in mind that when death rate is greater than birth rate, the population declines; when birth rate is greater than death rate, the population increases. Which one of the following statements about the population's behaviour can NOT be inferred from the plot? (Do not worry about exact numbers)



- a) When population size is at 6 individuals or at 34 individuals, the population will neither grow nor decline.
- b) When population size is below 6 individuals, the population will decline till it goes locally extinct
- c) When population is above 34 individuals, the population will decline till it goes locally extinct. ✓
- d) If population size is between 6 and 34 individuals, the population will grow till it reaches an abundance of 34.

22. Displayed below is a set of histograms and boxplots.



Match the histogram to the corresponding boxplot. Remember that the boxplots show the 1st and 3rd quartiles, with the thick line within being the median.

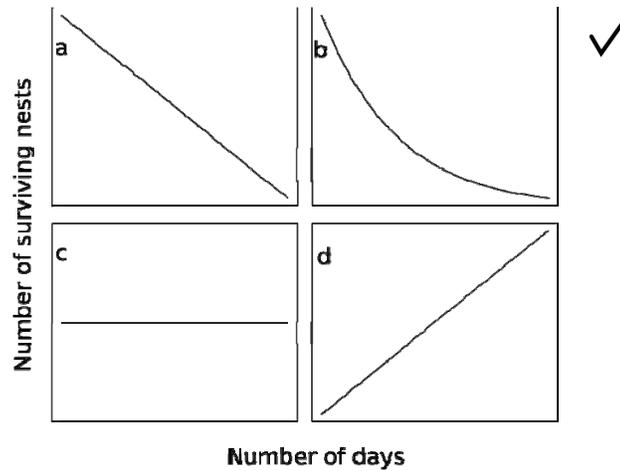
- a) a-iii, b-i, c-ii ✓
- b) a-ii, b-iii, c-i
- c) a-i, b-iii, c-ii
- d) a-iii, b-ii, c-i

23. I estimate the density of mouse-deer in areas with different levels of grass growth. I find that where grass biomass is  $0.5 \text{ Kg/m}^2$ , mouse-deer density is 1 individual per hectare. Where grass biomass is  $2.5 \text{ Kg/m}^2$ , mouse-deer density is 2 individuals per hectare. Imagine that you want to draw this information on a graph. What is the equation of the line that describes the relationship between mouse-deer density and grass biomass in the form  $y = a + b \cdot x$ , where  $y$  is mouse-deer density,  $x$  is grass biomass,  $a$  is the intercept and  $b$  is the slope of the line?

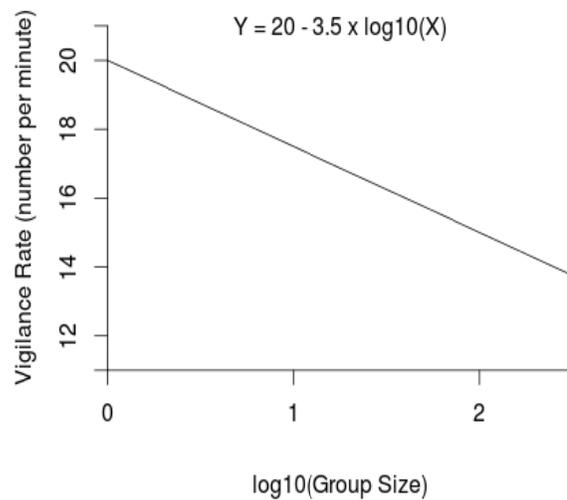
- a)  $a = 0.75, b = 0.5$  ✓
- b)  $a = 0.5, b = 0.75$
- c)  $a = 0.5, b = 2$
- d)  $a = 2, b = 0.5$

24. If the daily probability of survival of a bulbul nest (i.e. the probability that it escapes predation) is 90%, how do you expect the number of surviving nests to change over time (number of days)?

Choose a, b, c or d from the following figures.



25. The figure below shows the estimated relationship between vigilance rate and group size ( $\log_{10}$  – transformed) of an antelope species. According to this graph, what is the vigilance rate of solitary individuals?



- a) 0
- b) 14
- c) 17.5
- d) 20 ✓

26. A population biologist wants to estimate the number of Malabar spiny dormouse (*Platacanthomys lasiurus*) in a forest fragment. She traps 100 of them, puts tags on their ears and releases them back into the forest. After a week she goes back and sets out traps in the fragment again. This time she captures 75 of which 25 were the ones she had trapped earlier. Using this information, which of the formulas given below will you use to estimate the population size (N) of dormouse in the fragment. You can assume that the population is closed (i.e. no births, deaths, immigration or emigration occurred between the two trapping events) and the chance of being caught was the same for all individuals at all times.

- a)  $N = 100 \cdot 75 / 25$  ✓
- b)  $N = 25 \cdot 100 / 75$
- c)  $N = 100 + 75 - 25$
- d)  $N = 100 \cdot (75 - 25)$

27. You are given the following facts: i) C3 plants will be positively affected, whereas C4 plants will not be affected by a doubling of current CO<sub>2</sub> concentrations in the atmosphere; ii) C3 plants will be negatively affected, while C4 plants will be positively affected by a 5 degree Celsius increase in mean air temperature. Given a future climate with double atmospheric CO<sub>2</sub> concentration and a 5 degree Celsius increase in mean air temperatures, which of the following statements are true:

- a) C4 plants will perform better and replace all C3 plants.
- b) C3 plants will perform better and dominate.
- c) There will be no change in the performance or abundance of either C3 or C4 plants
- d) There is not enough information to make any prediction about the relative abundance of C3 and C4 plants ✓

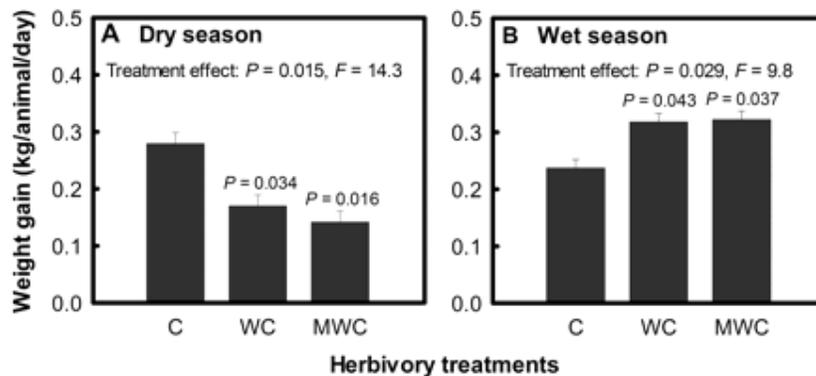
28. Measures of species diversity incorporate two quantities: species richness, which is a count of species, and evenness, which is a measure of how similar the abundances of different species are. More species rich and more even communities are considered more diverse than communities having fewer species and less evenness.

Based on the abundances of species in different communities provided below, indicate which of the following statements is true.

	Spec. A	Spec. B	Spec. C	Spec. D
Community 1:	70	10	10	10
Community 2:	50	50	50	50
Community 3:	30	30	30	30
Community 4:	35	5	5	5

- a) Community 1 has highest diversity
- b) All four communities have the same diversity
- c) Diversity of Community 2 > Community 3 > Community 1 > Community 4
- d) Diversity of Community 2 = Community 3 > Community 1 = Community 4 ✓

29. The figure below shows the weight gain of cattle within treatment fences that were accessible exclusively to them (C) and those they shared with wild herbivores but not mega-herbivores (WC; Note: Mega-herbivores are herbivores that weigh more than 1000 kg on average) or those that they shared with wild herbivores and mega-herbivores (MWC) during the dry season (A) and during the wet season (B). Error bars are standard errors ( $n = 3$  experimental blocks). When the P values over WC and MWC bars are  $<0.05$ , this means that weight gain in those treatments is significantly different from the C treatment. [from Odadi et al. *Science* 23 September 2011:vol. 333 no. 6050 1753-1755]



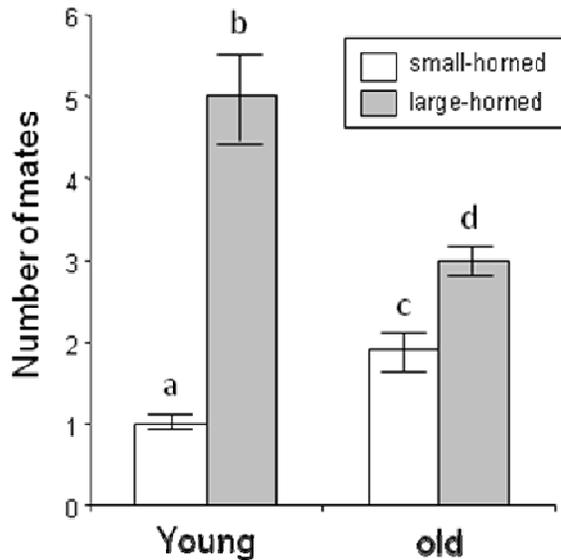
Which of the following statements about the above figure is true?

- a) Cattle do not compete with wild herbivores in either season
- b) Cattle compete with wild herbivores in the dry season but not in the wet season ✓
- c) Cattle do not compete with wild herbivores in the dry season
- d) Cattle do not compete with mega-herbivores in the dry season

30. You are interested in finding out whether the addition of small amounts of inorganic Nitrogen to Himalayan meadows affects the biomass and diversity of herbs. To do this you decide to add Nitrogen fertilizer to a series of 10x10m plots, each of which is paired with an adjoining 'control' plot that has no Nitrogen added. You decide to align the pairs in an East-West line; within each pair, one plot is to the North of the other. How should you best arrange the control and Nitrogen-treated plots in each pair?

- a) Nitrogen-treated plot to the North of the control plot in 100% of pairs
- b) Nitrogen-treated plot to the North of the control plot in 75% of pairs, rest to the South of the control plot
- c) Nitrogen-treated plot to the North of the control plot in 50% of pairs, rest to the South of the control plot ✓
- d) Nitrogen-treated plot to the North of the control plot in 25% of pairs, rest to the South of the control plot

31. Male sheep of a certain species show two types of horn phenotypes: large-horned or small-horned. The average mating success of the two different horned phenotypes at different ages is shown below. Error bars represent standard errors. When the characters over the bars are different, it means that those means are significantly different. Which of the following statements about this figure is INCORRECT?

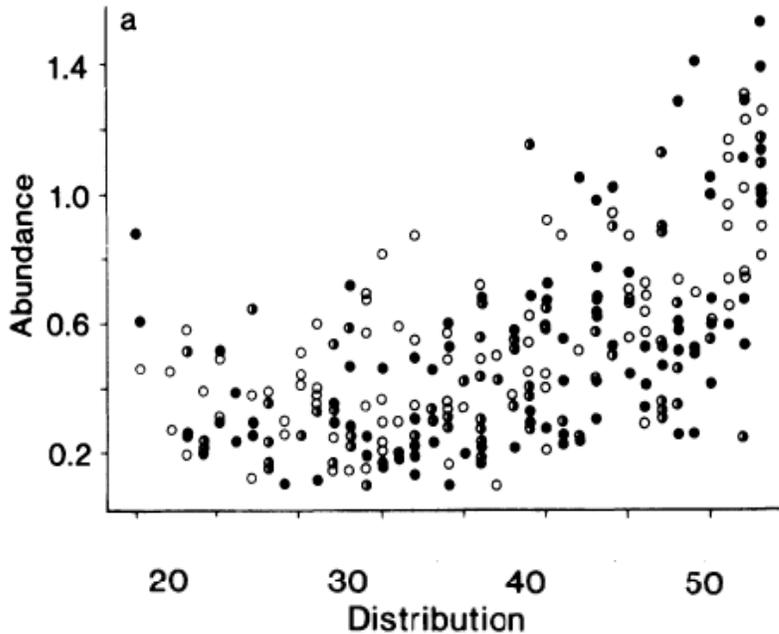


- a) Among small-horned males, mean mating success of older males is greater than younger males
- b) Mean mating success of old, small-horned males is lower than that of old, large horned males
- c) Large-horned males consistently have greater mean mating success than small-horned males
- d) Mean mating success of the two different horned morphs changes with age in the same manner ✓

32. You want to test whether guppy fish reduce their movement in the presence of a predator. To do this, you have two tanks, one with a carnivorous fish and one with a herbivorous fish. Into these tanks, you want to place 10 guppies each from a holding tank that has 20 guppies. What is the best way to choose which guppies to put into which experimental tank in order to answer your question:

- a) Assign each guppy a number and flip a coin to decide whether each guppy goes into the predator or the non-predator tank. ✓
- b) Catch 10 guppies and put them into the predator tank, then catch the rest and place them in the non-predator tank
- c) Catch 10 guppies and put them into the non-predator tank, then catch the rest and place them in the predator tank
- d) Catch 5 guppies and put them in the non-predator tank, catch the next 5 and put them in the predator tank, catch the next 5 and put them in the non-predator tank, and place the remaining 5 in the predator tank.

33. The graph below shows the relationship between the distribution (number of different geographic sites at which a species of moth was caught) and the abundance (expressed as log mean density for a species across all sites) for 263 species of British moths (the black dots are noctuid moth species while the white dots are sphingid moth species; Gaston, K.J. & Lawton, J.H., 1988, Nature). Which of the following sentences best describes the relationship between the distribution and abundance?

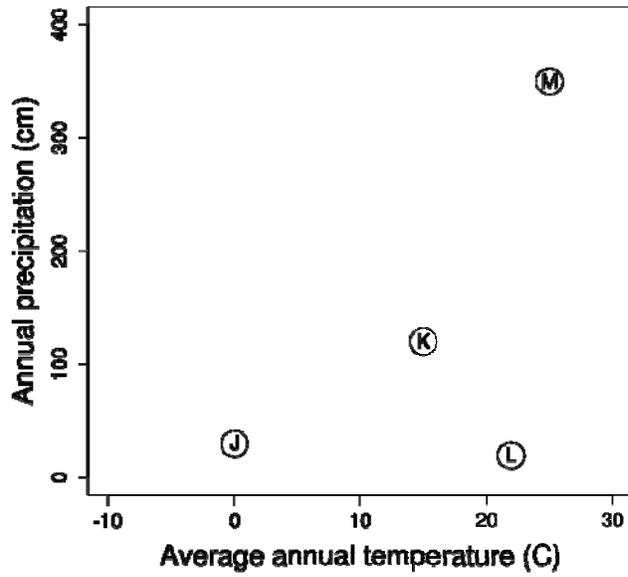


- a) Species with abundances below 0.6 tend to be widely distributed.
- b) On average, species with wider distributions are also more abundant. ✓
- c) All species that are distributed across more than 40 sites tend to be highly abundant.
- d) Narrowly distributed species are also more variable in their abundance.

34. In a study researchers found that poaching in protected areas exhibited a significant negative relationship with the number of forest guards in these areas (Pearson's correlations coefficient,  $r=0.786$ ,  $p < 0.001$ ). Solely based upon these results, we can correctly infer that:

- a) Managers assign fewer guards to protected areas with higher poaching
- b) Lower number of guards in protected areas result in increased poaching
- c) There is no relationship between poaching and number of guards in protected areas
- d) Protected areas with more guards are associated with less poaching. ✓

35. In the following figure, the dots represent four biomes (distinct vegetation types) that occur under distinct combinations of mean annual temperature and mean annual precipitation. Carefully examine these dots and visualize in your mind the biomes they might represent. Which of these biomes is likely to have the highest biodiversity?



- a) L
- b) K
- c) M ✓
- d) J

### SECTION 3

36. What is the name of the ministry in the Indian government responsible for India's environmental and forestry policies and programmes?

- a) Ministry of Environment
- b) Ministry of Environment, Forest and Climate Change ✓
- c) Ministry of Environment and Forests
- d) Ministry of Forests and Wildlife

37. Rank the following category of protected areas in India in terms of the increasing restrictions on permitted human activities:

A. Wildlife sanctuary B. National park C. Reserve Forest D. Conservation reserves

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

38. Which one of the following species is endemic to India (i.e. it is not found in the wild in any other country)?

- a) Bonnet Macaque ✓
- b) Snow Leopard
- c) Great Hornbill
- d) King Cobra

39. Which of the following protected areas would you have to visit to see an ecosystem comprising montane grasslands interspersed with forests patches called 'Sholas'?

- a) Kaziranga NP, Assam
- b) Kedarnath WLS, Uttaranchal
- c) Eravikulam NP, Kerala ✓
- d) Kanha NP, Madhya Pradesh

40. Which endangered species has been in the news in recent years due to concerns over a proposed Indian military radar facility affecting its habitat?

- a) Desert Fox
- b) Lesser Flamingo
- c) Narcondam Hornbill ✓
- d) Himalayan Ibex

41. A significant climate change-related landmark was established in the year 2012 when, for the first time in a million years, mean global atmospheric CO<sub>2</sub> concentrations exceeded:

- a) 4 parts per billion
- b) 400 parts per million ✓
- c) 4,000 parts per million
- d) 4,00,000 parts per million

42. Which of the following is NOT a specific criterion in assessing the threat status of a species according to the IUCN (International Union for the Conservation of Nature) Red Listing protocol:

- a) Absolute geographic range
- b) Change in population size
- c) Sex ratio of adult individuals ✓
- d) Absolute population size

43. Which of the following habitats is the Dipterocarpaceae plant family most strongly associated with?

- a) Arid grasslands
- b) Subtropical pine forests
- c) Tidal mangrove forests
- d) Lowland rainforests ✓

44. The Atlas Mountains are a mountain range in which continent?

- a) Africa ✓
- b) Europe
- c) North America
- d) Australia

45. Which of the following statements about the geological ages of the Himalayas and the Western Ghats is true?

- a) The Himalayas are older than the Western Ghats
- b) The Himalayas are younger than the Western Ghats ✓
- c) The Himalayas are of comparable age to the Western Ghats
- d) The relative ages of the Himalayas and the Western Ghats are not known

46. Which of the following tree species is not native to India?

- a) Peepal
- b) Sal
- c) Teak
- d) Tamarind ✓

47. Tides are the periodic rise and fall of large bodies of water on earth, caused by the gravitational pull of the sun and the moon. A spring tide (with the highest high and lowest low tide) occurs when:

- a) the sun exerts its maximum gravitational pull
- b) the sun is closest to earth
- c) the sun, moon and earth are aligned in a straight line ✓
- d) snow melt from rising spring temperatures is maximum.

48. Which of the following is not a greenhouse gas?

- a) CO<sub>2</sub>
- b) CH<sub>4</sub>
- c) N<sub>2</sub> ✓
- d) N<sub>2</sub>O

49. Fossils of marine shells, palaeozoic corals and many other marine organisms have been recorded from many locations on the Himalayas, including some of the highest peaks. Which of the following statements is a correct explanation for this observation?

- a) Himalayas were formed by volcanic activity
- b) A large part of the Himalayas have been formed due to upliftment of the seafloor ✓
- c) Sea levels have fallen substantially (by more than 20,000 feet since) since the fossilization of these organisms
- d) Ancestors of many marine organisms came from land

50. A population of the Indus River Dolphin has been recently discovered in the one of the following rivers in India.

- a) Kosi
- b) Teestaa
- c) Chambal
- d) Beas ✓

51. If the mouth of a river dwelling fish species is on the ventral side of its body and has a sucker-like structure, which of the following inferences about this fish is most likely to be true?

- a) This fish is a blood-sucking species
- b) This fish is a bottom-dwelling species ✓
- c) This fish has exceptional swimming ability
- d) This fish can swim upstream with ease

52. The closest relatives of hedgehogs, out of the following, are:

- a) Porcupines
- b) Armadillos
- c) Shrews ✓
- d) Mice

53. The 10<sup>th</sup> Conference of the Parties to the Convention on Biological Diversity (CoP 10) held in Japan in 2010 set a series of goals pertaining to biodiversity conservation. These are known as:

- a) The Millennium Development Goals
- b) The Kyoto Targets
- c) The Aichi Targets ✓
- d) The Sustainable Development Goals

54. Match the following authors to their books: A. Ghazala Shahabuddin B. Jim Corbett C. Valmik Thapar D. George Schaller 1. Jungle Lore 2. Stones of Silence 3. Conservation at the Crossroads 4. Land of the Tiger.

- a) A-2, B-1, C-4, D-3
- b) A-4, B-3, C-1, D-2
- c) A-3, B-1, C-4, D-2 ✓
- d) A-3, B-4, C-1, D-2

55. Which of the following accurately denotes the relationship between net primary productivity (NPP) and gross primary productivity (GPP)? [Note:  $R_{\text{total}}$  = Total respiration,  $R_{\text{night}}$  = night-time respiration]

- a)  $\text{NPP} = \text{GPP} + R_{\text{total}}$
- b)  $\text{GPP} = \text{NPP} + R_{\text{total}}$  ✓
- c)  $\text{GPP} = \text{NPP} - R_{\text{night}}$
- d)  $\text{NPP} = \text{GPP} - R_{\text{night}}$

56. Birds are more closely related to:

- a) Mammals than to all extant reptiles
- b) Crocodiles than to other extant reptiles ✓
- c) Fish than to mammals
- d) Duck-billed Platypus than to cows

57. Match (i) Jane Goodall, (ii) Dianne Fossey, and (iii) Birute Galdikas to the following: (1) Gorilla, (2) Chimpanzee, (3) Orangutan.

- a) i-1, ii-2, iii-3
- b) i-2, ii-3, iii-1
- c) i-3, ii-2, iii-1
- d) i-2, ii-1, iii-3 ✓

58. According to the equilibrium model of island biogeography, also known as the MacArthur-Wilson model, the number of species on an island represents a balance between:

- a) speciation rate on the mainland and extinction rate on the island
- b) speciation rate on the island and emigration rate away from the island
- c) immigration rate to the island and extinction rate on the island ✓
- d) immigration rate to the island and emigration rate away from the island

59. X visited a protected area and saw the following species in the wild: Tiger (*Panthera tigris*), Indian Rhinoceros (*Rhinoceros unicornis*), Asian Elephant (*Elephas maximus*) and Swamp Deer (*Rucervus duvaucelii*). Which of these protected areas could X have possibly visited?

- a) Periyar Tiger Reserve
- b) Kanha National Park
- c) Corbett National Park
- d) Kaziranga National Park ✓

60. The cattle egret (*Bubulcus ibis*) is often found following cattle in fields. As the cattle graze, their movement stirs up insects, which the egret then feeds on. The cattle themselves seem unaffected by the egret's behaviour. Based on this information, which term do you think best describes this interaction between egret and cattle?

- a) Mutualism
- b) Predation
- c) Commensalism ✓
- d) Parasitism

61. Which of the following is not an example of a mutualism?
- a) Lichens
  - b) Rhizobia and leguminous plants
  - c) Corals and zooxanthellae
  - d) Barnacles and whales ✓
62. A cost commonly associated with group living in animals is:
- a) less competition for food
  - b) higher exposure to disease and parasites ✓
  - c) better access to mates
  - d) decreased per capita risk of predation
63. If the per capita growth rate of a species is a positive constant, then
- a) The population size grows linearly
  - b) The population size grows exponentially ✓
  - c) The population size is constant
  - d) The population size grows logarithmically
64. The last glacial maxima or the last ice age ended 18,000 years ago. At this time
- a) The area of landmass on the Indian subcontinent was lower
  - b) Sri Lanka and India were connected by a landbridge ✓
  - c) India was covered by an ice sheet
  - d) India was still part of Africa
65. Which of the following was not a part of Darwin's theory of natural selection?
- a) Evolution is a gradual process and occurs over many generations
  - b) More individuals are born than will survive
  - c) Variation occurs between individuals in a population
  - d) Mutation is the ultimate source of variation ✓
66. In a diploid organism, the coefficient of relatedness,  $r$ , between father and daughter is:
- a) 1
  - b) 0.5 ✓
  - c) 0.25
  - d) 0.125
67. In humans, the genes that cause haemophilia are sex-linked and occur on the X chromosome. A human male has a recessive allele of this gene. What is the likelihood that his son will inherit this allele?
- a) 0% ✓
  - b) 25%
  - c) 50%
  - d) 100%

68. An inbred mouse strain was experimentally produced in which the activity of a single gene was eliminated by mutation. All females of this mutant strain showed a defect in one maternal behavior: they did not crouch protectively over their pups as normal mice mothers did. One may conclude that:

- a) All maternal behaviour is controlled by a single gene
- b) All maternal behaviour is genetically pre-programmed
- c) Maternal behaviour is too complex to be under genetic control
- d) Alteration in a single gene can change a maternal behaviour ✓

69. A species of mice can have gray or black fur and long or short tails. A cross between black-furred, long-tailed mice and gray-furred, short-tailed mice produce all black-furred, long-tailed offspring. Using the gene symbols G for black, g for gray, S for long and s for short, what would be the genotype of a gray-furred, short-tailed mouse?

- a) GGSS
- b) ggSS
- c) ggss
- d) GgSs ✓

70. The legless condition that is observed in several groups of extant reptiles is the result of:

- a) their common ancestor having been legless.
- b) a shared adaptation to an arboreal (living in trees) lifestyle.
- c) several instances of the legless condition arising independently of each other. ✓
- d) individual lizards adapting to a fossorial (living in burrows) lifestyle during their lifetimes.

71. Fossils of which one of these animals have been found in India?

- a) Polar Bear
- b) Kangaroo
- c) Hippopotamus ✓
- d) Capybara

72. Choose the odd one out

- a) Eohippus
- b) Sabre-toothed cat
- c) Woolly Mammoth
- d) Archaeopteryx ✓

73. Choose the odd one out

- a) Opossum
- b) Hyaena ✓
- c) Kangaroo
- d) Tasmanian Devil

74. Which of these ecosystems has the highest primary production per square meter?

- a) an open ocean
- b) a tropical evergreen forest ✓
- c) a grassland
- d) a salt marsh ✓

Because tropical evergreen forests may be interpreted by many to mean tropical rainforests (although they include less productive dry evergreen forests), both b and d have been allowed as correct answers for question 74. Salt marshes and tropical rainforests are both highly productive.

75. In recent media coverage of environmental issues and recent scientific literature, there has been much talk, discussion and debate about the “The Anthropocene”. This refers to:

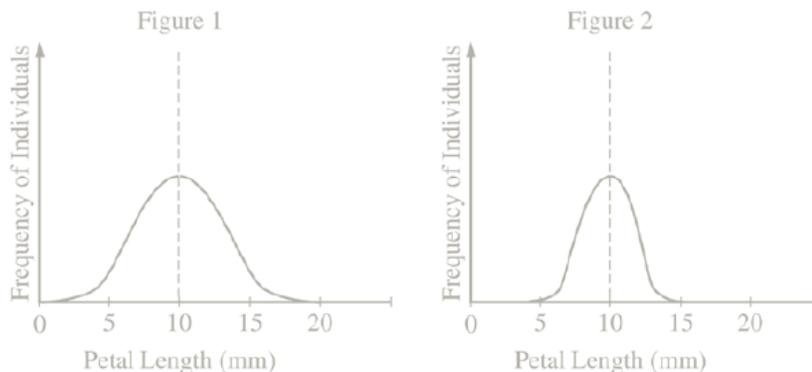
- a) The sixth human-driven mass extinction event through which we are now living.
- b) A tipping point in the earth system where human activities push atmospheric carbon dioxide concentration past 450ppm.
- c) The current epoch where human activities have significantly altered earth system processes. ✓
- d) The period of time since *Homo Sapiens* evolved as a distinct species.

**Note: Only Q 1 to Q 75 were scored. Q 76 to Q 80 were not scored.**

76. In the months leading up to this examination, an event with the ability to dramatically alter earth’s atmosphere has been taking place. This is:

- a) The approach of near-earth asteroid Eros to a point much closer to the earth’s atmospheric boundary than ever before.
- b) The smoldering of wildfires across vast tracts of peat forests in Indonesia, Borneo and Malaysia.
- c) The billowing of smoke plumes from Indonesia’s Mount Krakatoa as it accelerates towards its predicted eruption before the end of the year.
- d) The recent commencement of drilling for fossil fuels beneath the Arctic sea ice by G8 nations.

77. A plant species arrives on an island for the first time, where it is exposed to a new set of pollinators. Over the course of 20 generations, the characteristics of its flowers change. The figure below shows the distribution of petal length in the original population (Figure 1) and in the population after 20 generations (Figure 2). Examine the two figures carefully. Which of the following explanations is consistent with the observations:



- a) Pollinators on this island prefer flowers with longer petals
- b) Pollinators on this island prefer flowers with shorter petals
- c) Pollinators on this island prefer flowers with extremely long or extremely short petals
- d) Pollinators on this island prefer flowers with intermediate sized petals

78. Biodiversity decreases from the equator to the poles. Which of the following is not a possible explanation for the underlying mechanism for this pattern:

- a) Higher abiotic stress at higher latitudes
- b) Increased temperatures and productivity at lower latitudes
- c) Lower rates of speciation at lower latitudes
- d) Higher rates of extinction at the poles

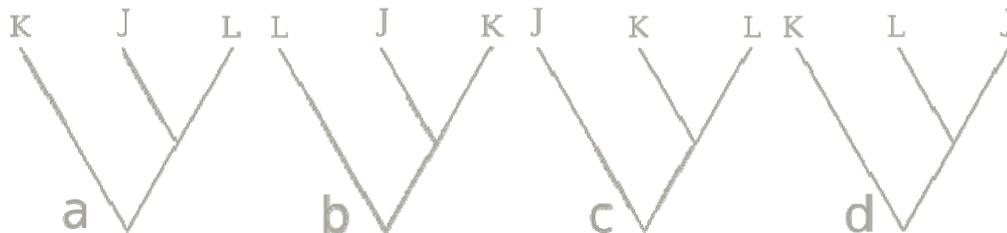
79. The most likely sequence for evolution of life on earth is:

- a) aerobic prokaryotes-photosynthetic prokaryotes-anaerobic prokaryotes-eukaryotes-multicellular organisms.
- b) photosynthetic prokaryotes-anaerobic prokaryotes-aerobic prokaryotes-eukaryotes-multicellular organisms.
- c) anaerobic prokaryotes-photosynthetic prokaryotes-aerobic prokaryotes-eukaryotes-multicellular organisms.
- d) eukaryotes-anaerobic prokaryotes-photosynthetic prokaryotes-aerobic prokaryotes-multicellular organisms.

80. The taxa J, K and L, show the presence (Y) or absence (N) of four traits as listed in the table below.

	1	2	3	4
J	Y	Y	Y	N
K	N	Y	Y	N
L	N	N	Y	Y

Based on this information, you are asked to build a phylogeny (a hypothesis about the evolutionary relatedness between the species). Based on the information in the table above, which of the following possible phylogenies is the most likely? Choose a, b, c or d.



## SECTION 4

*Write an essay, in English, of not more than 700 words on **ONE** of the following questions. Only the first 700 words of the essay will be evaluated, so please follow this word limit. Please use the allotted sheets for this work. Extra sheets will not be given.*

*(Please note that your essay will only be evaluated if you score the minimum qualifying scores in each of Sections 1, 2, and 3)*

In several places in India, elephants come out of the forests to raid agricultural crops causing substantial loss to households who can ill afford it. This has been a major reason for a negative perception among people about elephants in particular, and wildlife in general. What do you think are the major reasons for this situation? And how would you attempt to resolve this?

OR

Across India, feral dogs in rural areas are known to hunt native wildlife. In urban areas, where they are more commonly referred to as stray dogs, they are known to form packs at night, and sometimes attack humans. Consider the potential causes and consequences of these behaviors. Should we worry about wildlife in areas where feral dogs occur? Or human safety in areas where stray dogs occur? Should feral and stray dogs be culled?