

**BIO 213 Diversity and Ecology**  
**Second Exam, Spring 2001**

Questions: 50

Time: 1 hour

**NOTE:**

**Don't forget to write your social security number on the answer sheet.**

**Read the questions carefully, pay particular attention to what is asked of you.**

**Darken the circle corresponding to the correct answer.**

**In case more than one answer is correct pick the best or most inclusive answer.**

1. The essence of R. A. Fisher's argument of why sex ratios generally tend to remain near 50:50 centers around the fact that.
  - (A) all sperm (both X and Y carriers) have an equal probability of fertilizing an egg
  - (B) 50:50 sex ratios are not adaptive but represent only remnants of a more primitive condition
  - (C) natural selection should favor equal innate mortality rates for both sexes
  - (D) Exactly as many sperm carry the X chromosome as carry the Y chromosome
  - (E) individuals of the sex in short supply are worth more (have a higher  $V_x$ ) on average than individuals of the more plentiful sex
  
2. The term **facultative sexuality** applies to populations which have
  - (A) strong sex-specific selection
  - (B) asexual reproduction
  - (C) sexual and parthenogenetic individuals at different times
  - (D) both self-fertilization and cross-fertilization at the same time
  - (E) both isogamy and unisexuality at the same time
  
3. In experiments with *Tribolium* beetles, artificial selection for \_\_\_\_\_ resulted in \_\_\_\_\_, demonstrating that senescence does in fact evolve.
  - (A) higher mortality -- higher reproductive value
  - (B) lower mortality -- higher age-specific fecundity
  - (C) decreased longevity -- higher reproductive value
  - (D) early reproduction -- decreased longevity
  - (E) early reproduction -- higher total lifetime fecundity
  
4. Which of the following is an example of sequential hermaphroditism?
  - (A) anisogamy
  - (B) protogyny
  - (C) monogamy
  - (D) polyandry
  - (E) polygyny
  
5. Differences between sperm and egg are a prime example of
  - (A) isogamy
  - (B) monogamy
  - (C) polygyny
  - (D) anisogamy
  - (E) hermaphroditism

6. Which one of the following is generally true for a K-strategist?
- (A) type III survivorship
  - (B) includes fugitive species
  - (C) parental care of offspring
  - (D) rapid development
  - (E) small body size
7. Net reproductive rate ( $R_0$ ) and intrinsic rate of natural increase ( $r$ ) are
- (A) always the same
  - (B) the same in stable populations but different in populations that are either growing or declining
  - (C) equal to one and zero, respectively, in stable populations
  - (D) greater than one and zero, respectively, in declining populations
  - (E) two of the above
8. Survivorship curves cannot be
- (A) rectangular
  - (B) inverse hyperbolic
  - (C) exponentially increasing
  - (D) different between the sexes
  - (E) none of the above
9. Fugitive species can be characterized as:
- (A) good competitors
  - (B) species in which local extinction and recolonization are rare
  - (C) species with good dispersal abilities
  - (D) species that generally occur in late successional stages
  - (E) two of the above
10. Concerning the maximizing of one's fitness, the primary problem that males have is
- (A) sperm are cheap
  - (B) a tendency to desert impregnated females
  - (C) appraising their own worth
  - (D) discerning who is the father of the offspring
  - (E) that the sex ratio is skewed in favor of females
11. Inverse-hyperbolic survivorship curves imply
- (A) low mortality in earlier age classes and relatively steep mortality thereafter
  - (B) high fecundity in earlier age classes and fairly low fecundity later on
  - (C) constant decline in mortality with age
  - (D) high juvenile mortality and relatively high survivorship at later ages
  - (E) constant number of deaths but increased fecundity at later ages
12. Which of the following phenomena can be attributed to negative density dependence?
- (A) Decline in per-capita birth rates with increased population size
  - (B) Increase in per-capita death rates with increased population size
  - (C) Constant intrinsic rate of increase
  - (D) Exponential population growth
  - (E) A & B

13. Which of the following would lead to territoriality?

- (A) Shortage of resources
- (B) High costs of defense and low fitness benefits
- (C) High benefits from defense and low costs
- (D) A & B
- (E) A & C

14-20. These questions are based on the following data for an **sexually reproducing** population with a stable age distribution. The population is closed ie:- there is no immigration or emigration, so changes in population size are attributable solely to births and deaths.

age	# of females	average # of daughters per mother
newborns	1000	0
1-yrs	300	0
2-yrs	250	2
3-yrs	200	3
4-yrs	100	1

14. The pattern of survivorship you see with respect to females in this population is most likely to be

- (A) Type I
- (B) Type II
- (C) Type III
- (D) none of the above
- (E) can't say

15. From the replacement rate, and assuming no density-dependence, you conclude that the population

- (A) remains constant through time
- (B) declines exponentially
- (C) declines linearly
- (D) increases exponentially
- (E) cannot be predicted

16. The difference between gross- and net- reproductive rates

- (A) is 4.8
- (B) represents the effects of declining survivorship with age
- (C) represents the effects of a peak in fecundity at age 3
- (D) A and B
- (E) A and C

17. Life-expectancy of a newborn is

- (A) 0.55
- (B) 1.85
- (C) Lower than life expectancy of a 1-yr old
- (D) A and C
- (E) B and C

18. Reproductive value of a 4-year old is

- (A) 0.1
- (B) 0.5
- (C) 0.6
- (D) 1
- (E) 6

19. If resources were not limiting, natural selection in this population

- (A) would favor early reproducers
- (B) would favor late reproducers
- (C) would not act on this population
- (D) would decrease fecundity
- (E) would decrease survivorship in all age classes

20. Currently, the average age at which all offspring are born is

- (A) 2
- (B) 2.6
- (C) 2.8
- (D) 3.2
- (E) 4

21. Which of the following is a result of epigamic (intersexual) selection?

- (A) Females are attracted to brightly colored males
- (B) The evolution of monogamy
- (C) Male sticklebacks exhibit parental care
- (D) Females are often more choosy about mates than males
- (E) All of the above

22. In some animals (e.g. stickleback fish) paternal investment in offspring exceeds maternal investment. The evolution of this phenomenon may be due to:

- (A) sexual dimorphism
- (B) kin selection
- (C) reciprocal altruism
- (D) intrasexual selection
- (F) external fertilization

23. Ecological specialists

- (A) perceive their resources in a fine-grained manner
- (B) perceive their resources in a coarse-grained manner
- (C) are “jacks of all trades but masters of none”
- (D) (A) and (C)
- (E) none of the above

24. *Mola Mola*

- (A) is an agamid
- (B) lives in the Kalahari desert
- (C) deposits a clutch of 200 million eggs per female
- (D) is found in Borneo
- (E) has high juvenile survivorship.

25. In which of the following cases would the residual reproductive value be the lowest?

- (A) In a bird that is just about to migrate to the tropics to overwinter
- (B) In salmon that have just finished spawning
- (C) In a newborn insect
- (D) In a newborn mammal
- (E) In offspring just after the period of parental care

26. *Gambelia*

- (A) are Teiids
- (B) eat other lizards
- (C) are arboreal
- (D) are active, widely foraging lizards
- (E) are found in Australia.

27. *Nucras tessellata*

- (A) are Lacertids
- (B) live in the Kalahari desert
- (C) eat scorpions
- (D) are active during the heat of the day
- (E) all of the above

28. *Zonosaurus*

- (A) are found in Borneo
- (B) live in Australia
- (C) are found in the Kalahari desert
- (D) are found in the Amazonia
- (E) are found in Madagascar.

29. *Dracaena*

- (A) are Lacertids
- (B) eat other lizards
- (C) are arboreal
- (D) are from Amazonia
- (E) are found in Australia.

30. Having a stable age distribution implies that the population is **necessarily**

- (A) increasing
- (B) decreasing
- (C) constant
- (D) fluctuating
- (E) none of the above

31. For a population at equilibrium

- (A)  $R_0 = 1, r = 0$
- (B)  $R_0 = 0, r = 1$
- (C)  $R_0 = 0, r = 0$
- (D)  $R_0 = 1, r = 1$
- (E) none of the above

32. If the birth and death rates of a population are density independent, the curve obtained by plotting population size against time will be:

- (A) linear
- (B) logistic
- (C) logarithmic
- (D) exponential
- (E) none of the above

33. The **polygyny threshold** is defined as

- (A) the minimum difference in cost of producing a male versus a female which determines the sex ratio in the next generation
- (B) the minimum difference in habitat quality of territories held by males in the same region that is sufficient to favor bigamous matings by females
- (C) the point at which, after a few minutes of resistance, a female submits to a male that already has a mate
- (D) a particular time near the end of the breeding season when a female decides that it is better to mate with a male that already has a mate than to risk not being mated at all
- (E) a territorial boundary set up by a polygynous male which restricts his females from becoming part of the neighboring male's group of females

34. If we were walking through the woods and came across a traditional breeding ground (lek) of ruffed grouse, we would see

- (A) several alpha males competing for a majority of the copulations
- (B) females choosing males that are closest to them
- (C) evidence for polygyny
- (D) little variance in male mating success
- (E) great variance in female mating success

35. The phenomenon in which per-capita birth rates decline with increase in density

- (A) illustrate positive density dependence
- (B) illustrate negative density dependence
- (C) illustrate density independence
- (D) none of the above
- (E) all of the above

36. Data showing positive correlation between percentage change in density and population density exist for

- (A) insects
- (B) fish
- (C) birds
- (D) humans
- (E) non-human mammals

37. All the following explanations for population cycles involve interactions **among** species except

- (A) Predator-prey oscillation
- (B) parasite-load
- (C) food quantity
- (D) time lags
- (E) food quality

38. All the following may be defended except

- (A) nesting territories
- (B) feeding territories
- (C) home ranges
- (D) mating territories
- (E) C and D

39. Which of the following explain patterns in bird reproductive tactics?

- (A) determinate clutch size
- (B) indeterminate clutch size
- (C) nidicolous chicks
- (D) nidifugous chicks
- (E) all of the above

40. Tradeoffs between current reproductive effort and residual reproductive value

- (A) are convex upward for iteroparous organisms
- (B) are convex upward for semelparous organisms
- (C) are concave upward for semelparous organisms
- (D) A and B
- (E) A and C

41. The prey-diversity hypothesis has been invoked to explain

- (A) Small mammal cycles in the tundra
- (B) tradeoffs between growth and reproduction
- (C) epigamic selection in birds
- (D) latitudinal gradients in avian clutch size.
- (E) none of these

42. A cohort of newly born individuals has a size of 400 and a sex ratio of 0.25. If there is no mortality during the period of parental care, the tertiary sex ratio will be

- (A) 0.25
- (B) 0.20
- (C) 0.4
- (D) 0.15
- (E) cannot say

43. If the secondary sex ratio in the above population is 0.5, we can definitely conclude that there was

- (A) higher mortality of daughters during period of parental care
- (B) higher mortality of sons during period of parental care
- (C) equal investment in sons and daughters during period of parental care
- (D) absence of parental care for daughters
- (E) none of the above.

44. Possible explanation(s) for the observed primary sex ratio:

- (A) Sons are energetically cheaper to produce
- (B) Daughters are energetically cheaper to produce
- (C) The population has a deficit of females
- (D) A and C
- (E) B and C

45. The total rate of increase of populations growing in a density-dependent way predicted by the logistic model

- (A) would be greatest at low population sizes
- (B) would be greatest at the carrying capacity
- (C) would be greatest at half the carrying capacity
- (D) would be greatest when  $(1 - n/k) = 1$
- (E) would be greatest when death rates are negatively density dependent.

Questions 46-50

- (A) Age distribution
- (B) Density-dependant mortality
- (C) Intrinsic rate of increase,  $r$
- (D) Carrying capacity,  $K$
- (E) Survivorship

Which of the above would be used to characterize each of the following situations?

NOTE: USE EACH ANSWER ONLY ONCE!

46. Several pairs of fish are introduced to a newly created reservoir and they multiply rapidly.

- (A) (B) (C) (D) (E)

47. The average blacktail deer lives through 6 % of its life span, while the average human completes 67 % of his/her life span.

- (A) (B) (C) (D) (E)

48. Local sanitary conditions improve, resulting in a decrease in populations of many garbage feeding insects.

- (A) (B) (C) (D) (E)

49. Houseflies have a better chance of surviving in an uncrowded container than in a crowded one.

- (A) (B) (C) (D) (E)

50. In declining populations of hawks, the immature birds are relatively rare.

- (A) (B) (C) (D) (E)