Use the following information for the next three questions. In a population of dandelions: adults produce 60 seeds each; 1% of seeds survive to become adults; 50% of first-year adults survive to reproduce again; second-year adults never survive

1. If we call first-year adults (the first class we count) age 1, what is the value of ℓ_1?

A. 0.005
B. 0.01
C. 0.5
D. **1**

2. Make a life table (with two rows) for this population, assuming censusing is done before reproduction. What is the value of the reproductive number $\mathcal{R}$?

A. 0.6
B. **0.9**
C. 1.2
D. 1.5
E. 1.8

If we count before reproduction, we see only adults. These have survival probabilities of 0.5 and 0 respectively. All adults produce 60 seeds, of which 1% will survive to be counted as adults themselves.

We thus get the following life table (NOT UPDATED YET):

x	f_x	p_x	ℓ_x	$\ell_x f_x$
1	0.8	0.5	1.000	0.800
2	0.8	0	0.500	0.400
R				1.200

3. Which of the following is *not* an example of a tradeoff?

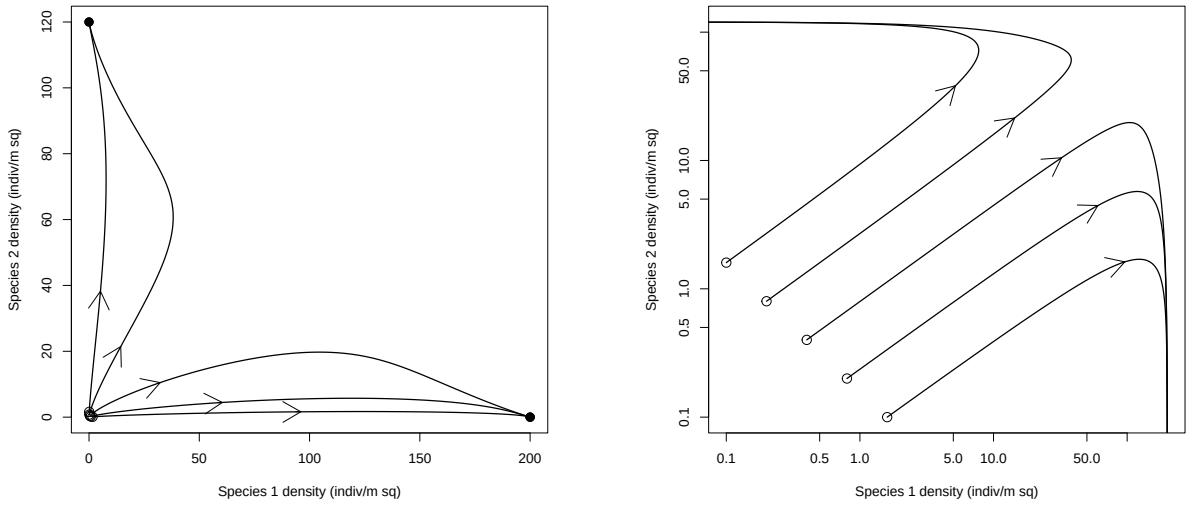
A. Birds with heavier beaks need more resources, but can eat a wider variety of seeds
B. **Smaller voles can reproduce more quickly and are less likely to be eaten by foxes**
C. Squirrels defend food resources more effectively from other squirrels are more likely to be eaten by foxes
D. Plants that invest more energy in seed dispersal have less energy to invest in the seeds themselves
E. The time you spend thinking about this slightly weird answer could reduce the amount of time you have for the rest of the test

4. In a reciprocal-control system, predator density-dependence tends to make cycles spiral _____ the equilibrium, because it reduces predator growth rates when _____ densities are the highest

A. **towards; predator**
B. towards; prey
C. away from; predator
D. away from; prey

5. The range where red squirrels live has shrunk dramatically in recent decades. If it is true that this is due only to competition from grey squirrels, we can conclude that due to the introduction of grey squirrels:

A. The realized and fundamental niches of red squirrels are smaller than before
B. **The realized niche of red squirrels is smaller than before, but the fundamental niche is unchanged**
C. The fundamental niche of red squirrels is smaller than before, but the realized niche is unchanged
D. The realized and fundamental niches of red squirrels are unchanged



Use the phase plot above (shown on two different scales) for the next two questions.

6. The figures show

A. Balanced competition
B. Equal competition
C. **Founder control**
D. Dominance
E. Coexistence

7. Species _____ has a larger value of K (when compared using units shown), and species _____ has a larger value of $r_{\max}$.

A. **1; 1**
B. 1; 2
C. 2; 1
D. 2; 2

8. We expect founder effects (mutual exclusion) to occur when

A. Each species does better in an environment dominated by competitors than in an environment dominated by its own species
B. **Each species does better in an environment dominated by its own species than in an environment dominated by competitors**
C. One species does better in an environment dominated by its own species, while the other does better in an environment dominated by competitors
D. One species does better than the other in environments dominated by either species

9. A certain kind of spider invests 10 times as much energy in each female egg as in each male egg (and does no further parental care of its offspring). If this species has random mixing between males and females, so that the balance argument holds, what ratio of female to male eggs should females evolve to produce?

A. 10:1
B. 5:1
C. 1:1
D. 1:5
E. **1:10**

10. What is the primary reason that edible fruits evolved?

A. To increase adult survival
B. To increase offspring survival
C. To provide resources for offspring growth
D. **To facilitate offspring dispersal**

11. Which of the following equilibria is usually *not* relevant in a system with one exploiter e and one resource species f?

A. $r_e = r_f = 0$
B. $r_e = N_f = 0$
C. $N_e = r_f = 0$
D. $N_e = N_f = 0$
E. They can all be relevant
ANS: B

In a system where the exploiter depends on the resource, we expect $r_e < 0$ (exploiter decline) when $N_f = 0$ (no food).

12. A pile of radioactive material is decaying *continuously* at an instantaneous rate of 1%/minute. After two *hours*, what proportion is left?

A. A little more than 98%
B. Exactly 98%
C. A little less than 98%
D. **About 30%**
E. None

13. In a linear population model, we expect:

A. The reproductive number $\mathcal{R}$ is always > 1
B. The instantaneous growth rate r is always > 1
C. The finite growth rate λ is always > 1
D. $\mathcal{R} > 1$ exactly when $r > 1$
E. $\mathcal{R} > 1$ **exactly when** $\lambda > 1$

14. In a wet forest landscape with good soils, tree species compete primarily for light. If an area where the disturbance rate is very *high*, which species would we expect to dominate?

A. **The species with the highest growth rate at high light ($r_{\max}$)**
B. The species with the highest individual-level competitive effect on other species (α)
C. The species with the highest population-level competitive effect on other species (E)
D. The species with the lowest light level at which it reaches equilibrium

15. If competition between two species is "balanced", we expect the competitive result to be

A. mutual exclusion
B. co-existence
C. **the species with the higher population-level competitive effect (E) on the other one to win**
D. the species with the higher individual-level competitive effect (α) on the other one to win

16. A landscape is changing over decades, so that sometimes conditions are good for dry-adapted plants, and sometimes they are bad. A short-lived aloe species and a long-lived cactus species are dry-adapted plants living on this landscape. At any given time their $\mathcal{R}$ value are roughly similar. Compared to the longer-lived cactus, the shorter-lived aloe would be expected to have higher λ:

A. Never
B. Always
C. **Only when conditions are good**
D. Only when conditions are bad

17. Which of the following would *not* be expected to lead to Allee effects?

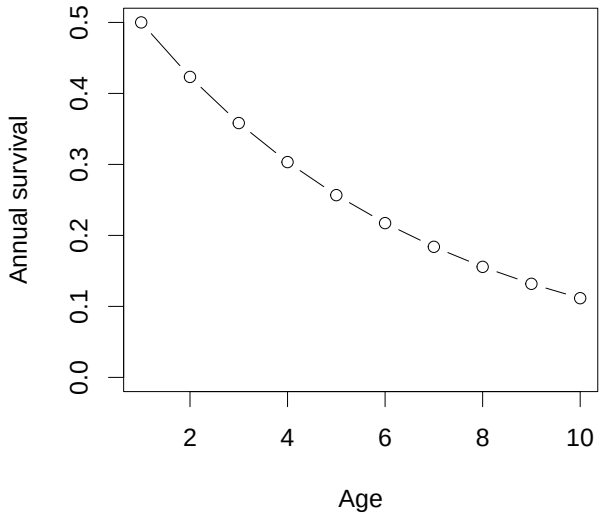
A. Individuals co-operating to find food
B. Individuals having difficulty finding mates
C. **Individuals competing for breeding sites**
D. Individuals co-operating to look out for predators

18. Compared to r strategists, we would generally expect K strategists to put _____ total resources into _____.

A. more; female relative to male offspring
B. less; female relative to male offspring
C. more; dispersal relative to offspring survival
D. **less; dispersal relative to offspring survival**

19. Which of the following is *not* a potential advantage of producing fewer offspring with a given amount of energy?

A. Resources can be used to improve offspring survival probability
B. Resources can be used to improve likely offspring reproductive success
C. Resources can be used to improve offspring dispersal
D. **Resources can be saved for the adult to use in subsequent reproductive seasons**

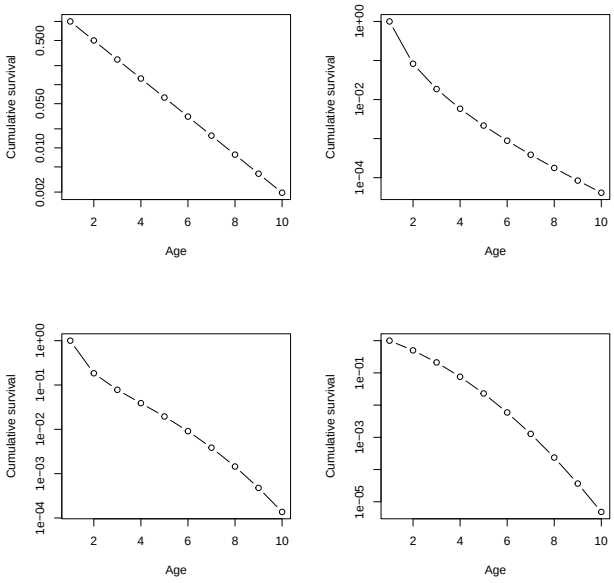


Use the picture above for the following 2 questions.

20. What does this picture of survivorship in an idealized age-structured population indicate about *mortality* in this population?

A. Mortality is constant
B. **Mortality is elevated in older individuals**
C. Mortality is elevated in younger individuals
D. Mortality is elevated in both older and younger individuals

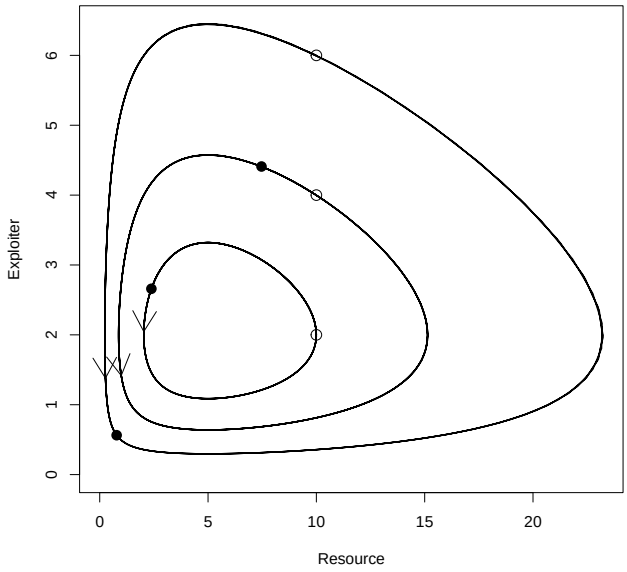
21. The pictures below show *cumulative* survival. Which one corresponds to the picture shown above?



A. Upper left
B. Upper right
C. Lower left
D. **Lower right**

22. If a bacterium is highly adapted to dramatic changes in conditions (ranging from very good growth conditions to very bad), we would expect it to:

A. Have a very fast life cycle
B. Have a very slow life cycle
C. **Have adaptations that speed up its life cycle in good conditions and slow it down in bad conditions**
D. Have adaptations that speed up its life cycle in bad conditions and slow it down in good conditions



Use the figure above for the next two questions. It shows a simple model of an interaction between an exploiter and a resource species.

23. The figure shows:

A. Unstable oscillations
B. **Neutral oscillations**
C. A limit cycle
D. Damped oscillations

24. This figure is consistent with a simple model that has: _____ density dependence and _____ predator satiation

A. **No; no**
B. No; weak
C. No; strong
D. Prey; weak
E. Prey; strong

25. Which of the following effects tends to *damp* oscillations in a predator-prey interaction model?

A. Density dependence in the predator
B. Density dependence in the prey
C. Predator satiation
D. **Either A or B**
E. Either B or C