

Game Theory in the Natural World

Game Theory · Answer Key · 20 Questions

1. In evolutionary game theory, what is the term for a strategy that, if adopted by all members of a population, cannot be invaded by any alternative strategy?

- A) Cooperative Equilibrium
- B) Dominant Strategy
- C) Evolutionarily Stable Strategy (ESS)**
- D) Nash Equilibrium

2. The 'Hawk-Dove' game in evolutionary biology models conflict between two strategies. What does the 'Dove' strategy represent in this model?

- A) Aggressive escalation
- B) Costly fighting
- C) Avoidance and retreat
- D) Display without fighting**

3. What concept in game theory helps explain why some species exhibit reciprocal altruism, such as vampire bats sharing blood meals?

- A) Tragedy of the Commons
- B) Prisoner's Dilemma**
- C) Stag Hunt
- D) Coordination Game

4. In foraging behavior, the 'ideal free distribution' suggests that animals will distribute themselves in a way that equalizes their individual payoffs. This is an example of animals playing a game to maximize what?

- A) Territorial defense
- B) Predator avoidance
- C) Resource acquisition**
- D) Mating success

5. What type of game theory scenario describes the situation where two individuals might be better off cooperating, but each has an incentive to defect if the other cooperates?

- A) Coordination Game
- B) Zero-Sum Game
- C) Prisoner's Dilemma**
- D) Hawk-Dove Game

6. The 'Tragedy of the Commons' describes a situation where individual users, acting independently according to their own self-interest, behave contrary to the common good of all users by depleting or spoiling a shared resource. This is a game theory problem related to:

A) Predator-prey dynamics

B) Mutualism

C) Resource management

D) Sexual selection

7. In the context of animal communication, 'honest signaling' is a concept related to game theory. What does honest signaling prevent?

A) Cooperative breeding

B) Cheating or deception

C) Altruistic behavior

D) Kin selection

8. The concept of a 'Nash Equilibrium' in game theory suggests a state where:

A) All players achieve the best possible outcome

B) No player can improve their outcome by unilaterally changing their strategy

C) Cooperation is always the most beneficial strategy

D) The game ends immediately

9. What term describes a strategy in game theory that yields a better payoff regardless of what the other player does?

A) Nash Equilibrium

B) Evolutionarily Stable Strategy

C) Dominant Strategy

D) Retaliation Strategy

10. Many insects, like ants and bees, exhibit social structures where individuals sacrifice their own reproduction to help the queen. This is often explained by game theory through the concept of:

A) Resource partitioning

B) Kin selection

C) Predator satiation

D) Competitive exclusion

11. The 'Stag Hunt' is a game theory scenario that illustrates the conflict between:

A) Cooperation and mutual destruction

B) Individual ambition and collective reward

C) Aggression and avoidance

D) Resource scarcity and abundance

12. In the context of predator-prey interactions, 'evolutionary arms races' can be viewed through a game theory lens, where each species develops new strategies in response to the other. This is a dynamic that drives:

A) Symbiotic relationships

B) Biodiversity

C) Ecosystem stability

D) Food web simplification

13. When animals engage in 'mutualism,' where both species benefit, what is a likely game theory outcome for their interaction?

A) A zero-sum game

B) A stable cooperation

C) A dominant strategy for one species

D) A prisoner's dilemma

14. The 'sex-ratio' of offspring in many species is often close to 1:1. Evolutionary game theory explains this by considering the relative fitness of producing males versus females, suggesting a stable equilibrium where neither sex is favored in terms of reproductive success. This is an example of:

A) A dominant strategy for one sex

B) A Nash Equilibrium

C) A prisoner's dilemma

D) A tragedy of the commons

15. What type of game involves a situation where the total gains and losses are exactly zero, meaning one player's gain is another player's loss?

A) Coordination Game

B) Non-zero-sum Game

C) Zero-Sum Game

D) Prisoner's Dilemma

16. In predator avoidance, a strategy of 'mobbing' (where prey group together to harass a predator) can be effective. From a game theory perspective, this is an example of cooperation increasing individual survival by:

A) Increasing individual risk

B) Reducing the payoff for the predator

C) Encouraging the predator to leave

D) Distributing the risk among individuals

17. The concept of 'tit-for-tat' in repeated Prisoner's Dilemma games is a successful strategy characterized by:

- A) Always defecting
- B) Always cooperating
- C) Starting by cooperating and then mirroring the opponent's previous move**
- D) Starting by defecting and then cooperating

18. When animals compete for limited resources, such as food or mates, their interactions can be modeled as a game. A key outcome in such scenarios, often related to game theory, is the establishment of:

- A) Equal resource distribution
- B) Territorial boundaries or dominance hierarchies**
- C) Complete resource depletion
- D) Universal cooperation

19. Why might a prey animal engage in 'mimicry' of a more dangerous or unpalatable species?

- A) To increase its own predation risk
- B) To exploit a predator's learned avoidance of the dangerous species**
- C) To signal its own toxicity
- D) To facilitate cooperation with the dangerous species

20. The 'lekking' behavior in some bird species, where males gather in a display area to attract females, can be analyzed using game theory. What is a primary factor influencing a male's success on the lek?

- A) His ability to forage efficiently
- B) His genetic relatedness to other males
- C) His attractiveness to females and competition with other males**
- D) His willingness to cooperate with rivals