

# Cosmic Game Theory Dynamics

Game Theory · Answer Key · 10 Questions

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**1. In the context of the 'Kessler Syndrome' as a non-cooperative game, what is the primary factor that makes debris mitigation a 'tragedy of the commons' problem for orbital states?**

**A) The lack of a centralized enforcement agency to penalize satellite operators for generating space junk**

- B) The physical impossibility of tracking objects smaller than 10cm in Low Earth Orbit
- C) The exponential rate of atmospheric drag on objects below 500km altitude
- D) The requirement for geostationary orbit to be cleared of all defunct satellites

**2. Which game theory model best describes the strategic competition between nations to claim lunar poles for water-ice extraction, given that resource depletion is irreversible?**

A) The Stag Hunt

**B) The War of Attrition**

C) The Dictator Game

D) The Traveler's Dilemma

**3. When modeling the 'Fermi Paradox' as a game, what is the 'Dark Forest' theory's core assumption regarding communication between advanced civilizations?**

A) Information transfer is subject to the speed of light, making coordination impossible

**B) Any civilization that reveals its location is immediately perceived as a threat and eliminated**

C) Resource scarcity in the universe is absolute, leading to zero-sum conflict

D) Communication is inhibited by the gravitational lensing of distant galactic centers

**4. In orbital rendezvous maneuvers modeled as pursuit-evasion games, what prevents a simple linear intercept strategy?**

**A) The conservation of angular momentum forcing non-linear Hohmann transfer trajectories**

B) The requirement to maintain a constant relative phase angle in a vacuum

C) The influence of third-body perturbations on the target's trajectory

D) The non-Euclidean geometry of curved spacetime near massive bodies

**5. Which strategic concept explains why global satellite constellations (like Starlink) prioritize rapid deployment to secure orbital slots, effectively creating a 'first-mover advantage'?**

A) Nash Equilibrium

**B) Stackelberg Competition**

C) Pareto Efficiency

D) The Prisoner's Dilemma

**6. In the 'Interstellar Colonization' game, why is a high discount rate on future rewards problematic for the survival of humanity?**

- A) It incentivizes the consumption of local planetary resources before reaching a self-sustaining population**
- B) It ignores the relativistic time dilation experienced by interstellar travelers
- C) It results in the neglect of long-term life-support maintenance on generation ships
- D) It favors the development of autonomous AI over biological reproduction

**7. What is the primary constraint that prevents 'Cooperative Game Theory' from effectively managing the allocation of radio frequencies for deep-space telemetry?**

- A) The vast communication latency preventing real-time negotiation between distant observatories**
- B) The international law governing radio wave propagation in vacuum
- C) The inability of non-state actors to participate in ITU negotiations
- D) The dominance of ionospheric interference on deep-space signals

**8. When applying the 'Braess's Paradox' to interplanetary transport networks, what is the counterintuitive result of adding a new orbital transfer point?**

- A) The reduction of total transit time for all spacecraft in the system
- B) The congestion of high-efficiency Hohmann transfer windows
- C) The increase in total transit time due to a shift in impulsive maneuver allocation**
- D) The destabilization of stable Lagrange point orbits

**9. In the strategic interaction of 'Interplanetary Trade' between Earth and Mars, what factor dictates the game's move-set limitations?**

- A) The specific orbital resonance windows occurring approximately every 26 months**
- B) The constant solar wind pressure affecting light-sail transport
- C) The high cost of heavy-lift rocket fuel per kilogram
- D) The gravitational constant discrepancy between planets

**10. Why is the 'Zero-Sum' assumption frequently applied to the acquisition of rare-earth elements on asteroids?**

- A) The asteroids contain a finite volume of extractable material**
- B) The cost of asteroid mining exceeds the value of the materials recovered
- C) The legal status of asteroid minerals is limited to the first explorer who touches the surface
- D) The rapid decay of isotopes used for asteroid propulsion systems