What is Game Theory and Decision Analysis?

Worksheet

Game theory finds optimal strategies using concepts like Nash equilibrium (no player benefits from unilateral change) and identifies dominant strategies. It models payoffs (outcomes) for each combination of player choices, revealing which strategies are rational and stable.

Questions

1. In a price-setting game, both firms charge $100 and earn $50M. One firm cuts to $90 and earns $60M; the other falls to $40M. This is NOT a Nash equilibrium because:

A) Both firms earn the same
B) Prices are too high
C) The other firm will cut price too
D) It's unstable-each wants to deviate

2. Game theory predicts that without enforcement, cartels (price-fixing agreements) are:

A) Stable and profitable forever
B) Unstable-each firm tempted to cheat by cutting price
C) Illegal everywhere
D) Immune to competition

3. A company offers a discount to early customers. This is a strategic move to:

A) Lower costs
B) Create a first-mover advantage and lock in customers before rivals respond
C) Maximize short-term profit
D) Confuse competitors

4. When two firms cooperate instead of competing, the outcome is:

A) Always illegal
B) Win-win for both (higher profits)
C) Lower for consumers (higher prices)
D) Unstable unless enforced

5. Two companies in a duopoly pricing game. Both can charge High or Low. High yields $10M each if both charge High; $5M if one High, one Low; $2M each if both Low. What is the Nash equilibrium?

6. A software company (Firm A) wants to enter a market where Microsoft dominates. Should A match Microsoft's pricing or undercut?

7. Prisoner's Dilemma: Two suspects arrested. Each can Confess or Stay Silent. Confess: 3 years if partner silent, 2 if both confess. Silent: 5 years if partner confesses, 1 if both silent. What happens?

8. Define: What is a Nash equilibrium?

9. Define: What is a dominant strategy?

10. Define: In the Prisoner's Dilemma, why do both confess despite a worse outcome?

Answer Key

1. C) The other firm will cut price too - If one cuts price, the other will cut too to restore profitability they end up in a price war. Not stable.

2. B) Unstable-each firm tempted to cheat by cutting price - Each firm individually benefits by cutting price while others stay high. Without enforcement, cheating is inevitable.

3. B) Create a first-mover advantage and lock in customers before rivals respond - First-mover advantage shifts the game's payoff structure. Early lock-in is a credible commitment.

4. D) Unstable unless enforced - Cooperation beats competition in payoffs, but each firm is tempted to cheat. Needs contracts/reputation to hold.

5. If B charges High: A earns $10M (High) vs $5M (Low) A prefers High If B charges Low: A earns $5M (High) vs $2M (Low) A prefers High Same logic for B: always prefers High Nash equilibrium: Both charge High (each earns $10M) NOTE: Collusion (both stay High) requires enforcement; without it, both have incentive to deviate.

6. If A matches: Both profitable but slow growth for A; Microsoft may cut price or bundle features If A undercuts: Microsoft cuts price harder price war, both lose profitability Game-theoretic insight: Price war is a negative-sum game for both Better strategy: Differentiate on features, target a niche, avoid direct price competition Dominant strategy = differentiate, not compete on price alone.

7. From each suspect's view: Confessing yields 3 or 2 years; Staying Silent yields 5 or 1 year Rational choice for each: Confess (dominates staying silent) Nash equilibrium: Both confess 2 years each Paradox: Both would prefer staying silent (1 year each), but individually rationally choose confessing Lesson: Individual rationality collective optimality. Trust and enforcement break the dilemma.

8. A state where no player benefits from unilaterally changing their strategy. All players are playing their best response to others' strategies.

9. A strategy that is always optimal, regardless of what other players do. Playing a dominant strategy is always rational.

10. Each suspect individually prefers confessing (avoids 5 years if the other confesses). Individual rationality leads to collective irrationality.