What is Nash Equilibrium?

Worksheet

Nash Equilibrium is a strategic configuration where no player benefits from changing strategy alone, given the others' choices—the cornerstone of game theory.

Questions

1. Nash Equilibrium means...

A) Everyone is happy
B) No player benefits from unilateral change
C) The best outcome for society
D) All players earn the same

2. In the Prisoners' Dilemma, is mutual silence a Nash Equilibrium?

A) Yes
B) No—each prefers to confess
C) Only if players cooperate
D) It depends on payoffs

3. Can a Nash Equilibrium be worse for everyone than another outcome?

A) Never
B) Always
C) Yes—Prisoners' Dilemma example
D) Only in 2-player games

4. What does 'unilaterally' mean in Nash Equilibrium?

A) Everyone changes together
B) One player changes alone
C) A change by law
D) Random change

5. In the Prisoners' Dilemma, each player can confess or stay silent. If both stay silent, each gets 1 year. If one confesses and the other doesn't, the confessor gets 0 years and the other gets 5. If both confess, each gets 3 years. Where is the Nash Equilibrium?

6. Two firms choose to enter or stay out of a market. Entering costs 10, and profit depends on competition. If both enter: profit 15 each. If one enters, one out: profit 30 vs 0. If both stay out: profit 0. Find the Nash Equilibrium.

7. Rock-Paper-Scissors: each option beats one and loses to one. Is there a pure strategy Nash Equilibrium?

8. Define: Define Nash Equilibrium.

9. Define: Is Nash Equilibrium always socially optimal?

10. Define: Can a game have multiple Nash Equilibria?

Answer Key

1. B) No player benefits from unilateral change — NE is individually stable—not everyone's best off, just that no one can improve alone.

2. B) No—each prefers to confess — If one stays silent, the other benefits from confessing. So mutual silence is not NE.

3. C) Yes—Prisoners' Dilemma example — Prisoners' Dilemma: both confess (NE) yields 3 years each; both silent yields 1 year each.

4. B) One player changes alone — Unilateral = one-sided. At NE, one player can't improve by changing alone.

5. Check each player's incentive: If A stays silent → B confesses (0 years vs 5) If A confesses → B confesses (3 years vs 5) Both confess is NE (each prefers it given the other's choice) But both silent is socially better!

6. If rival stays out → I enter (30 > 0) If rival enters → I enter (15 > 0) Both firms enter is NE (dominant strategy)

7. If opponent plays Rock → I play Paper But then opponent switches to Scissors No pure NE exists Mixed strategy NE: play each 1/3 of the time

8. A strategic outcome where no player can improve their payoff by unilaterally changing strategy.

9. No—it's individually stable, not globally optimal. Prisoners' Dilemma is the classic counterexample.

10. Yes. Some have one, some have many, and some have none in pure strategies.