

SNS COLLEGE OF ENGINEERING

Kurumbapalayam (Po), Coimbatore – 641 107 An Autonomous Institution Accredited by NBA – AICTE and Accredited by NAAC UGC wit'A' Grade Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING IOT Including CS&BCT COURSE NAME : DISTRIBUTED LEDGER TECHNOLOGY

TOPIC: Nash Equilibriums





: Introduction to Nash Equilibrium

A Nash Equilibrium is a concept from game theory, introduced by mathematician John Nash. It refers to a situation in a game where no player can benefit by changing their strategy, given that the other players' strategies remain the same. In other words, a Nash Equilibrium occurs when each player's strategy is optimal, given the strategies of the other players. It's a central idea in analyzing competitive behaviors in economics, politics, and strategic decision-making.





Key Characteristics of Nash Equilibrium

A Nash Equilibrium has the following key features:

- 1. Mutual Best Response: Each player in the game chooses the best possible strategy for themselves, given the strategies chosen by others.
- 2. Stability: No player has an incentive to unilaterally change their strategy, as it would not lead to a better payoff.
- 3. Multiple Equilibria: Some games can have more than one Nash Equilibrium, while others may have a unique one. It depends on the structure and payoffs of the game.
- 4. Non-Cooperative: Nash Equilibria typically occur in non-cooperative games where players cannot form binding agreements with each other.





Example of Nash Equilibrium (Prisoner's Dilemma)

A classic example of Nash Equilibrium is the Prisoner's Dilemma:

• Two criminals are arrested and charged with a crime. They are offered a deal: if one betrays the other (defects), they go free, while the other receives a harsh sentence. If both remain silent (cooperate), they get a lighter sentence. If both betray each other, they both get moderate sentences.

In this scenario, the Nash Equilibrium occurs when both prisoners betray each other, even though they would have been better off if they both remained silent. Each prisoner reasons that if the other betrays, their best response is to betray as well, making it the optimal strategy for both.





Importance and Applications of Nash Equilibrium

Nash Equilibria are crucial in understanding competitive and cooperative strategies in various fields:

- 1. Economics: In oligopolies, firms reach Nash Equilibria when they choose pricing strategies that maximize their payoffs given competitors' prices.
- 2. Politics: Political parties may choose strategies (e.g., policies) that reflect the Nash Equilibrium, where each party's strategy is optimal given the strategies of the others.
- 3. Auction Theory: In bidding, a Nash Equilibrium represents a situation where each bidder knows the strategies of others and cannot improve their chances of winning by changing their bid.
- 4. International Relations: Countries in conflict may reach a Nash Equilibrium in situations of mutual deterrence, where neither party can improve their position by changing strategy.

