



Nash Equilibrium

Nash equilibrium is a concept in game theory where the game reaches an optimal outcome. This is a state that gives individual players no incentive to deviate from their initial strategy. The players know their opponent's strategy and still will not deviate from their initial chosen strategies because it remains the optimal strategy for each player.

Overall, an individual can receive no incremental benefit from changing actions, assuming that other players remain constant in their strategies. A game may have multiple Nash equilibria or none at all.

- The Nash equilibrium is a decision-making theorem within game theory that states a player has the best chance at achieving their desired outcome by not deviating from their initial strategy.
- In the Nash equilibrium, each player's strategy is optimal when considering the decisions of other players. Every player wins because everyone gets the outcome that they desire.
- The prisoner's dilemma is a common game theory example and one that adequately showcases the effect of the Nash equilibrium.
- The Nash equilibrium is often discussed in conjunction with the dominant strategy, which states that the chosen strategy of an actor will lead to better results out of all the possible strategies that can be used, regardless of the strategy that the opponent uses.
- The Nash equilibrium does not always mean that the most optimal strategy is chosen

Nash equilibrium is named after its inventor, John Nash, an American mathematician. It is considered one of the most important concepts of game theory, which attempts to determine mathematically and logically the actions that participants of a game should take to secure the best outcomes for themselves.

Nash Equilibrium vs. Dominant Strategy

Nash equilibrium is often compared to dominant strategy, both being strategies of game theory. The Nash equilibrium states that the optimal strategy for an actor is to stay the course of their initial strategy while knowing the opponent's strategy and that all players maintain the same strategy.

Dominant strategy asserts that the chosen strategy of an actor will lead to better results out of all the possible strategies that can be used, regardless of the strategy that the opponent uses.

All models of game theory only work if the players involved are “rational agents,” meaning that they desire specific outcomes, operate in attempting to choose the most



optimal outcome, incorporate uncertainty in their decisions, and are realistic in their options.

Both terms are similar but slightly different. **Nash equilibrium** states that nothing is gained if any of the players change their strategy while all of the other players maintain their strategy. **Dominant strategy** asserts that a player will choose a strategy that will lead to the best outcome regardless of the strategies that the other players have chosen. Dominant strategy can be included in Nash equilibrium, whereas a Nash equilibrium may not be the best strategy in a game.

Example of Nash Equilibrium

Imagine a game between Tom and Sam. In this simple game, both players can choose strategy A, to receive \$1, or strategy B, to lose \$1. Logically, both players choose strategy A and receive a payoff of \$1.

If you revealed Sam's strategy to Tom and vice versa, you see that no player deviates from the original choice. Knowing the other player's move means little and doesn't change either player's behavior. Outcome A represents a Nash equilibrium.

	A	B
A	1,1	1,-1
B	-1,1	0,0

What Is a Nash Equilibrium in Game Theory?

Nash equilibrium in game theory is a situation in which a player will continue with their chosen strategy, having no incentive to deviate from it, after taking into consideration the opponent's strategy.

How Do You Find Nash Equilibrium?

To find the Nash equilibrium in a game, one would have to model out each of the possible scenarios to determine the results and then choose what the optimal strategy would be. In a two-person game, this would take into consideration the possible strategies that both players could choose. If neither player changes their strategy knowing all of the information, a Nash equilibrium has occurred.

Why Is Nash Equilibrium Important?

Nash equilibrium is important because it helps a player determine the best payoff in a situation based on not only their decisions but also the decisions of other parties involved. Nash equilibrium can be utilized in many facets of life, from business strategies to selling a house, from war to social sciences, and so on.



How Do You Calculate Nash Equilibrium?

There is not a specific formula to calculate Nash equilibrium. It can be determined by modeling out different scenarios within a given game to determine the payoff of each strategy and which would be the optimal strategy to choose.

What Are the Limitations of Nash Equilibrium?

The primary limitation of Nash equilibrium is that it requires an individual to know their opponent's strategy. A Nash equilibrium can only occur if a player chooses to remain with their current strategy if they know their opponent's strategy.