

# Introduction to Game Theory and Nash Equilibria

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## Introduction

Politics is inherently strategic: politicians, voters, interest groups, and nations all have their own preferences, goals, and strategies. They must make decisions based not only on their own goals but also by anticipating and reacting to the decisions of others. Given that game theory provides a framework for understanding strategic interactions between individuals, this theory is well suited to a formal and rigorous study of politics.

Using game theory to study politics allows us to:

*Model Strategic Decision-making:* Game theory helps in modeling the complex strategic decisions made by political actors, whether they are individual politicians, political parties, or entire countries. It helps us understand how these decisions are made in the context of competing interests and strategic interactions with others.

*Predict Outcomes:* By analyzing strategic interactions as games, game theory can help predict the outcomes of various political scenarios. This could include the results of elections, the success of legislative initiatives, or the outcome of international negotiations.

*Understand Incentives and Constraints:* Game theory elucidates the incentives and constraints facing political actors. It allows us to see how different rules and structures of political environments (like electoral systems or international treaties) shape the behavior of those involved.

*Identify Equilibria:* Game theory provides tools to identify Nash equilibria in political scenarios, which are situations where no actor has an incentive to deviate from their chosen strategy, given the strategies of all other actors. Understanding these equilibria can explain why certain political outcomes occur and persist.

*Explore Cooperation and Conflict:* Politics often involves a mixture of cooperation and conflict. Game theory allows us to explore the conditions under which political actors are likely to cooperate or compete with one another.

By applying game theory to politics, we gain valuable insights into the strategic nature of political decision-making and interactions. This can help policymakers design better institutions and policies, and help citizens and analysts understand the complex dynamics of the political world. Our task hereafter will be to build a toolkit of game theoretical approaches to politics.

Now, let's apply these concepts to specific political scenarios through game theory problems.

Your task is to solve these problems by identifying the Nash equilibria and interpreting what these equilibria mean in the context of political strategies and outcomes.

## Practice Problems

Problem 1: A game involving two political candidates, each with three potential campaign strategies.

		Candidate 2		
		<i>Economic</i>	<i>Social</i>	<i>Security</i>
Cand. 1	<i>Economic</i>	3, 3	2, 2	0, 4
	<i>Social</i>	2, 1	4, 4	1, 3
	<i>Security</i>	4, 0	3, 1	2, 2

Problem 2: A game involving two political parties deciding on policy positions, with one party choosing from seven possible positions and the other from four.

		Party 2			
		<i>Lib</i>	<i>Mod</i>	<i>Con</i>	<i>Far</i>
Party 1	<i>Tax</i>	3, 3	1, 1	2, 2	1, 0
	<i>Env</i>	2, 1	4, 4	0, 0	1, 2
	<i>Edu</i>	1, 2	3, 3	5, 5	0, 1
	<i>Hlt</i>	2, 0	2, 1	1, 1	4, 4
	<i>Def</i>	0, 1	4, 4	1, 0	2, 3
	<i>Law</i>	1, 0	0, 1	4, 4	3, 2
	<i>Imm</i>	2, 2	1, 3	3, 1	5, 5

Problem 3: A game among three political entities (say countries) where Player 1 chooses the row, Player 2 chooses the column, and Player 3 chooses the table to play on.

**Table 1 (Normal Relations):**

		Country 2	
		<i>Trade</i>	<i>Diplomacy</i>
Country 1	<i>Trade</i>	3, 2, 1	1, 3, 2
	<i>Diplomacy</i>	2, 1, 3	4, 4, 4

**Table 2 (Tense Relations):**

		Country 2	
		<i>Sanctions</i>	<i>Negotiations</i>
Country 1	<i>Sanctions</i>	1, 3, 2	2, 1, 3
	<i>Negotiations</i>	4, 4, 4	3, 2, 1