Week 3 Reflection

**Task 1**

**Coordination Game:**

**Description:**

A coordination game is a basic two-player strategic interaction in which each player must choose between two possible strategies, typically labeled as "left" (L) and "right" (R). When both players select the same strategy, they both receive a positive payoff; however, if they choose different strategies, the payoff for both is reduced, typically resulting in zero gain. Nash equilibrium: the pure strategy equilibrium (L, L) and (R, R), as well as a mixed strategy equilibrium

| | **Player 2: L** | **Player 2: R** |
|---|---|---|
| **Player 1: L** | (2, 2) | (0, 0) |
| **Player 1: R** | (0, 0) | (2, 2) |

**Explanatory Note**:

Nash equilibrium refers to a strategic situation in which no player has an incentive to change their strategy unilaterally. In coordination games, there are three types of Nash equilibria: two pure strategy equilibria—(A, A) and (B, B)—and one mixed strategy equilibrium. In such an equilibrium, each player's strategy is the best response to the others', ensuring outcome stability. Coordination games show that Nash equilibrium can represent multiple stable outcomes. When both players choose A, they achieve the best payoff (3, 3). However, choosing B also results in a stable, though suboptimal, outcome with a payoff of (2, 2). The mixed strategy equilibrium implies that players may randomly choose strategies when no single pure strategy is strictly preferred.

**URL Link:**

https://colab.research.google.com/drive/1rlStETjwHVeCC0HTaedwsq5cnY4ACCz1?usp=sharing

**Reference:**

Osborne, Martin J. 2013. "An Introduction to Game Theory." In *SAGE Publications, Inc. eBooks*, 33–42. https://doi.org/10.4135/9781452275567.n5.

**Task 2**

**Definition:**

A Nash equilibrium of a strategic game $\langle N,(A_i),(\succcurlyeq_i)\rangle$ is a profile $a^* \in A$ of actions with the property that for every player $i \in N$ we have $(a_{-i}, a_i) \succcurlyeq_i (a^*_{-i}, a_i)$ for all $a_i \in A_i$.

**Reference**:

Osborne, Martin J., and Ariel Rubinstein. 1994. *A Course in Game Theory*. http://ci.nii.ac.jp/ncid/BA23229820.

**Paraphrase**:

1. A Nash equilibrium is a strategy combination where each player's strategy is optimal given other players' strategies
2. No player can improve their payoff by unilaterally changing their strategy while others keep theirs fixed
3. It represents a stable solution concept where mutual best responses create strategic stability
4. This self-enforcing property makes Nash equilibrium a fundamental solution concept in non-cooperative game theory
5. The definition applies to both pure and mixed strategies, providing a general framework for strategic analysis

**2. Existence Theorem**

**Quote**:

"Every finite n-player normal-form game (i.e., a game with finite strategy sets) has at least one Nash equilibrium, possibly in mixed strategies."

**Reference**:

Nash, John. 1951. "Non-Cooperative Games." *Annals of Mathematics* 54 (2): 286. https://doi.org/10.2307/1969529.

**Paraphrase**:

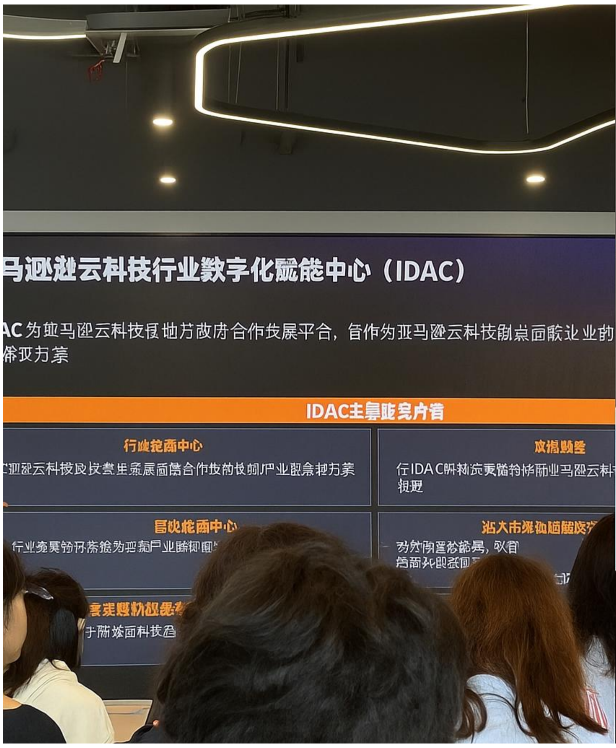
1. Nash's fundamental theorem guarantees that every finite game has at least one equilibrium solution
2. This existence result ensures that the Nash equilibrium concept is universally applicable to finite games
3. The proof relies on Brouwer's fixed-point theorem, connecting game theory to topology and analysis
4. Mixed strategies may be necessary when pure strategy equilibrium do not exist
5. This theorem provides theoretical foundation for using Nash equilibrium as a solution concept across diverse strategic situations

**Flowchart:**


**Reflection:**

The interaction between existence and complexity determines how the concept of equilibrium is applied in computational economics. The existence theorem of Nash guarantees that every finite game has at least one equilibrium, which makes the concept universally applicable and provides a reliable basis for modeling strategic interactions. However, mere existence does not guarantee realizability: complexity results show that even in simple two-person games, finding an equilibrium can be computationally intractable. This tension affects both theory and practice. On the one hand, economists can confidently build models around equilibria, knowing that such outcomes exist. On the other hand, researchers must confront the fact that agents, markets, or algorithms may not be able to compute or converge to these equilibria within a reasonable time. Therefore, computational economics often turns to approximation methods, learning dynamics, or structured classes of games where equilibria are tractable. Existence tells us that equilibria are always "there"; complexity tells us why the path to them may be difficult and why practical analysis must strike a balance between theoretical completeness and computational feasibility.

**Task 3**




**Part A Short Essay:**

Computational game theory holds significant promise for the entertainment industry by improving content allocation, pricing, and platform strategies. It can foster more efficient markets and stimulate innovation. Yet the peril lies in potential algorithmic collusion, excessive market concentration, and reinforcing addictive user behaviors. U.S. companies like AWS tend to empower entertainment through infrastructure—cloud services and scalable AI pipelines that enable studios and platforms to grow flexibly.

Chinese firms such as Tencent take a more integrated approach, embedding entertainment within social networks and payment systems to create all-encompassing digital ecosystems. This shows convergence in leveraging computational tools but divergence in governance and ecosystem design. In relation to **SDG 8 (Decent Work and Economic Growth)**, these strategies can generate new jobs, drive digital economies, and boost global creative industries. At the same time, they raise concerns about precarious labor, platform dependency, and whether growth in entertainment sectors is sustainable and inclusive.

**Part B:**

"How can we together do better?" The liberal arts tradition offers an answer: through critical reflection, interdisciplinarity, and ethical awareness. By examining problems from multiple perspectives, we avoid narrow technical fixes and instead design innovations that serve society responsibly. DKU's joint model, rooted in collaboration between Duke and Kunshan, extends this approach by bringing together diverse cultural and moral traditions. In the context of computational economics, this means not only advancing efficiency but also asking whose interests are served and what ethical trade-offs are acceptable. The convergence of Chinese and U.S. educational values at DKU fosters global leadership by encouraging students to synthesize differing cultural norms into broad, inclusive ethical guidelines. These shared principles can guide responsible innovation across borders, helping future leaders ensure that technologies like computational game theory contribute to sustainable and equitable economic growth.