**🎮 Game Theory Basics (for Fog Computing Project)**

**1. What is Game Theory?**

* **Game theory is the study of how multiple players make decisions when their outcomes depend on each other’s actions.**
* **In our project:**
  + **Players: IoT Users (buyers) + Fog Nodes (providers).**
  + **Goal of users: Minimize cost and latency.**
  + **Goal of providers: Maximize utilization and profit.**

**2. Key Terms**

* **Player: The decision-maker (user or fog node).**
* **Strategy: The choice a player makes (e.g., which fog node to connect to, what price to set).**
* **Payoff (Utility): The benefit a player gets after making a choice (e.g., low latency + low cost for users, high profit for providers).**
* **Equilibrium: The point where no player can do better by changing their choice alone.**

**3. What is Nash Equilibrium?**

* **A situation where no player can improve their outcome by changing their strategy while others keep theirs fixed.**
* **In our project:**
  + **Users pick fog nodes → Providers set prices → Users may move → Repeat.**
  + **When no user or provider wants to change, equilibrium is reached.**

**🔹 Example:**

* **Suppose there are 2 fog nodes.**
* **If too many users pick Node A → price goes up. Some users move to Node B.**
* **Eventually, both nodes have balanced load at a fair price.**
* **At this point → Nash equilibrium.**

**4. Utility Functions (Simple Form)**

**We use utility functions to calculate payoffs.**

* **For a User:  
  Utility\_user = - (Cost + Latency)  
  (lower cost and lower delay = higher utility)**
* **For a Provider:  
  Utility\_provider = Revenue - Resource Cost  
  (higher revenue but without wasting too many resources)**

**5. Dynamic Pricing Logic**

* **If demand > supply → increase price.**
* **If supply > demand → decrease price.**
* **This repeats until system reaches equilibrium.**

**6. Simple Analogy (Easy to Remember)**

**Think of it like Uber surge pricing 🚕:**

* **Too many customers, not enough drivers → price rises → some customers wait or choose other transport.**
* **When balance comes → no one has incentive to switch → equilibrium.**

**In our case:**

* **Users = passengers**
* **Fog nodes = drivers**
* **Dynamic pricing = surge pricing**

**📚 What to Read for Week 1**

**Here’s a crisp study plan (2 days is enough for basics):**

**Day 1 – Game Theory Basics**

* **Youtube: “Game Theory Explained in 10 Minutes” (many short videos are good).**
* **Topic to cover: Players, Strategies, Payoff, Equilibrium.**

**Day 2 – Nash Equilibrium**

* **Example: Prisoner’s Dilemma (classic intro).**
* **Focus on: Why no one can change strategy alone.**
* **Relate to fog computing → users and providers balancing.**

**📌 You do not need heavy math (like mixed strategies, complex proofs).  
📌 Just focus on concept + simple formulas like utility functions.**

**📝 What You’ll Use in the Project**

* **Players = IoT Users + Fog Nodes**
* **Strategies = Which node to select, what price to set**
* **Payoff = Cost, latency, profit**
* **Equilibrium = Stable allocation (no one changes)**
* **Pricing = Adjust until balance**