Glossary

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1. **Rationality:** The key methods used to analyze the data gathered through systematically gathered observations**.**
2. **Instrumental Rationality:** Individuals are solely interested in satisfying their own preferences or desires. Instrumental rationality often fails to prescribe a unique course of action. This presupposes that individuals are able to determine, at least probabilistically, the outcome of their actions, and have preferences over these outcomes.
3. **Moral rationality (Immanuel Kant):** Individuals behave rationally if they act according to *categorical imperatives.* These are laws that prescribe a certain type of behavior derived from reason alone.
4. **Bounded rationality (Herbert Simon):** individuals have limited computational ability. As a result of these limitations individuals may well adopt procedures, or rules of behavior, that help them to achieve satisfactory outcomes.
5. **Rational actor**: An individual operating largely with instrumental rationality. The actor need not be selfish. Indeed, if rationality implied selfishness, the only rational individuals would be sociopaths. A rational individual must maintain *consistent preferences*. Furthermore, we will assume that all actors possess identical rationality.
6. **Player**: An individual who makes decisions.
7. **Nature**: A pseudo-player who takes random actions at specified points in the game with specified probabilities.
8. **Mutual interdependence:** The welfare of any one individual in a game is, at least partially, determined by the actions of other players in the game.
9. **Strategic decision-making**: individuals seek to anticipate the effect their own actions will have on the behavior of others.
10. **Fair bet**: a bet that pays its stake (or price) in expectation.
11. **Decision theory:** Analysis of the behavior of an individual facing nonstrategic uncertainty—that is, uncertainty that is due to what we term "Nature".
12. **Game Theory:** Game theory is concerned with how rational individuals make decisions when they are mutually interdependent.
13. **Non-cooperative (i.e., competitive) game:** Individuals, or players, in a game are unable to enter into binding and enforceable agreements with one another. Due to this assumption non-cooperative game theory is inherently individualistic.
14. **Cooperative game***: A*nalyzes situations where agreements among individuals are possible.
15. **Static Game:** In a static game each agent has a set of possible strategies to choose from, and a payoff function. An example of a static game is a *one-off sealed bid auction*.
16. **Dynamic Game:** Games have a sequence to the order of play and players observe some, if not all, of one another's moves as the game progresses. Later players have some knowledge about earlier actions. In multiperiod and repeated games, it is necessary for players to update beliefs by incorporating new information provided by each round of play. An example of a dynamic game is a so-called *English auction*.

17. **Sequential Game:** A game where one player chooses his action before the others choose theirs. Time in sequential games is implicit by turn taking. Sequential games are in contrast to simultaneous games where analysis is about strategy profiles.
18. **Coordination game:** A class of games (opposite of competitive Games) with multiple pure strategy Nash equilibria in which players choose the same or corresponding strategies
19. **Complete information:** Every player will know the payoff that each agent will obtain depending on what actions have been taken.
20. **Incomplete Information:** There is at least one player that does not know the payoff of at least one player. At the first point in time when the players can begin to plan their moves in the game, some players have private information about the game that other players do not know.
21. **Common knowledge:** Information is common knowledge if it is known to all the players, if each player knows that all the players know it, if each player knows that all the players know that all the players know it, and so forth ad infinitum.
22. **Strategy:** a rule that tells a player which action to choose at each instant of the game.
23. **Pure strategy**: a series of actions that fully define the behavior of a player.
24. **Mixed strategy**: A mixed strategy is an active randomization, with given probabilities, that determines the player's decision. As a special case, a mixed strategy can be the deterministic choice of one of the given pure strategies.
25. **Certainty/uncertainty**: A game of certainty has no moves by Nature after any player moves. Otherwise the game is one of uncertainty.
26. **Payoff:** This is a quantity represented by a number, also called utility that reflects the desirability of an outcome to a player, for whatever reason. When the outcome is random, payoffs are usually weighted with their probabilities. The expected payoff incorporates the player's attitude towards risk.
27. **Strategic form:** A game in strategic form, also called normal form, is a compact representation of a game in which players simultaneously choose their strategies. The resulting payoffs are presented in a table with a cell for each strategy combination. Two player versions are commonly but not when there are many players.
28. **Extensive game:** An extensive game (or extensive form game) describes with an upside down tree how a game is played as players take turn. It depicts the order in which players make moves, and the information each player has at each decision point.
29. **Equilibrium**: A strategy profile consisting of a best strategy for each of the n players in the game.
30. **Nash equilibrium:** A Nash equilibrium (NE), also called strategic equilibrium, is a list of strategies, one for each player, which has the property that no player can unilaterally change his strategy and get a better payoff. It is possible that a player may prefer a strategy that is superior to NE (i.e., yields a higher payoff). NE is of primary interest for analysis and not by each player. A game may have multiple NE.
31. **A Solution:** Given a game, we will predict which will be the outcome (*equilibrium)* that will prevail in the game (E.g., elimination of strictly dominated strategies, Nash equilibrium). The players make their moves in isolation without knowing what other players have done. This does not necessarily mean that all decisions are made at the same time, but rather only *as if* the decisions were made at the same time.

32. **Perfect NE:** A NE that is not dominated. As such it is preferred solution among multiple NE.
33. **Combinatorial game theory**: A mathematical theory that studies two-player games, which have a *position* in which the players take turns changing in defined ways or *moves* to achieve a defined winning condition. (E.g., Chess).
34. **Dominated strategy:** A strategy is dominated if it is strictly inferior to some other strategy no matter what strategies the other players choose.
35. **Pareto efficiency:** An **outcome** *a* of **game form** *π* is (strongly) pareto efficient if it is **undominated** under all preference profiles.
36. **Acceptable game:** A **game form** such that for every possible **preference profiles**, the game has **pure Nash Equilibria**, all of which are **pareto efficient**.
37. **Weakly acceptable game:** A game that has **pure Nash equilibria** some of which are **pareto efficient**.
38. **Simple game**: A simplified form of a cooperative game, where the possible gain is assumed to be either '0' or '1'.
39. **Dictator:** A player is a *strong dictator* if she can guarantee any outcome regardless of the other players. $m \in \mathbb{N}$ is a *weak dictator* if she can guarantee any outcome, but her strategies for doing so might depend on the complement strategy vector. Naturally, every strong dictator is a weak dictator.
40. **Cooperative game:** A game in which players are allowed to form coalitions (and to enforce coalitionary discipline). A cooperative game is given by stating a *value* for every coalition.
41. **Coalition:** Any subset of the set of players: $S \subseteq N$.
42. **Backward induction:** Backward induction is a technique to solve a game of perfect information. It first considers the moves that are the last in the game, and determines the best move for the player in each case. Then, taking these as given future actions, it proceeds backwards in time, again determining the best move for the respective player, until the beginning of the game is reached.
43. **Zero-sum game:** A game is said to be zero-sum if for any outcome, the sum of the payoffs to all players is zero. This is a special case of constant sum games. In a two-player zero-sum game, one player's gain is the other player's loss, so their interests are diametrically opposed. E.g., most sporting events.
44. **Constant-sum game:** A game is said to be constant-sum if for any outcome, the sum of the payoffs to all players is a fixed, constant value. In a two-player constant-sum game, one player's gain is the other player's loss, so their interests are diametrically opposed. The equilibrium of such games is often in mixed strategies. E.g., most sporting events.
45. **Variable Sum Game:** The sum of all player's payoffs differs depending on the strategies they utilize. This is the opposite of a constant sum game in which all outcomes involve the same sum of all player's payoffs. In variable sum games, players have some interests in common which may lead to all players being better off through cooperation.
46. **Bargaining Problem:** Each agent i has a utility function u_i defined over the set of all possible deals.
47. **Evolutionary Game Theory:** Application of game theory to interaction dependent strategy evolution in populations.
48. **Player type:** The initial private information that a player has at the first point in time when she begins to plan her moves in the game.

49. **Bayesian form games (John Harasyani, 1968):** Games with incomplete information. A Bayesian game can be modeled by introducing Nature as a player in a game. Nature assigns a random variable to each player which could take values of *types* for each player and associating probabilities or a probability density function with those types.
50. **Strategic substitutes**: games with scenarios that allow for free riding or have a public-good structure of play.
51. **Strategic Complements**: The benefit that an individual obtains from buying a product or undertaking a given behavior is greater as more of her partners do the same.
52. **Stochastic dominance:** A term used in decision theory to situations where one gamble (a probability distribution over possible outcomes, also known as prospects can be ranked as superior to another gamble.
53. **Network game:** An agent well being depends on his or her own actions as well as on the actions taken by his or her neighbors.
54. **Fictitious Play:** A process by which players assume that the strategies of their opponents are randomly chosen from some unknown stationary distribution. In each period, a player selects her best response to the historical frequency of actions of her opponents. The process was first noted by Julia Robinson who also noted that the process converges to the equilibrium for two-player zero sum games. While the process does not always converge in other settings, it is known that if it converges, then the point of convergence is Nash equilibrium of the game.
55. **Games that are not interesting:** There is always a winning strategy for a player as long as the player plays optimally, e.g., tic-tac-toe.
56. **Free Rider Problem:** A situation commonly arising in public goods contexts in which players may benefit from the actions of others without contributing (they may free ride). Thus, each person has incentive to allow others to pay for the public good and not personally contribute. In short, the free rider problem occurs because one does not have incentive to account for the global benefits of a private act, such as in the tragedy of the commons game.
57. **Utility:** It represents the motivations for players. A utility function for a given player assigns a number for every possible outcome of the game with the property that a higher number implies that the outcome is more preferred. utility functions may either ordinal in which case only the relative rankings are important, but no quantity is actually being measured, or cardinal, which are important for games involving mixed strategies
58. **Graphical games** (Kearns, 2001): The payoff to player i is a function of the actions of only those players in the neighborhood of vertex i in the graph.