1 Game Theory

> **Definition 1.1: Game Theory**
>
> **Game theory** is the set of concepts and model for social and political phenomena.

In game theory, there are two types of questions:

1. **Conceptual**: meaning of the words (e.g., cooperation, rationality)

2. **Technical**: construction in the analysis of models

1.1 Models

> **Definition 1.2: Model**
>
> A **model** is is an abstraction we use to understand our observations and experiences.

Models cannot be judged by an absolute criterion rather its merit lies on the purpose in which we use it. As such, it starts with an idea related to the interaction of a decision-maker. From there, the model is analyzed by discovering its implications through logic to yield results that confirms our original idea.

2 The Theory of Rational Choice

> **Definition 2.1: Theory of Rational Choice**
>
> The **theory of rational choice** is that a decision-maker chooses the best actions according to his/her preferences among all the actions available.

This theory lies on the consistency of one's decisions when faced with different sets of available actions not likes/dislikes.

> **Definition 2.2: Instrumental Rationality**
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> **Instrumental rationality** is someone who is capable of evaluating actions available to them.

> **Definition 2.3: Substantive Rationality**
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> **Substantive rationality** is someone who pursues sensible goals (e.g., spend a day at the beach as opposed to prison).

2.1   Actions

A set A consisting of all actions available to the decision-maker and a specification of the individual's preferences. The decision-maker is faced with a subset of A to choose one element.

For example, John, a California high school student, applies to all of the University of California (UC) schools:

- *applied* = {Berkeley, Davis, Irvine, Los Angeles, Merced, Riverside, San Diego, Santa Barbara, Santa Cruz}

John prefers *San Diego* due to its infamous Cognitive Science program though *accepted*, shown below, are choices that aren't his preferences. Rather the school he gets accepted due are based off the decison of the admission officers.

- *accepted* = {Berkeley, Los Angeles}

Now John, has to accept a single offer based off X factors. As such, he chooses a single element from *accepted* (a subset of *applied*):

- *college* = {Los Angeles}

2.2   Preferences and Payoff Functions

A decision-maker (John) is indifferent when choosing between actions (*accepted*). John prefers *UCLA* than *UC Berkeley* given its financial aid package.

> **Definition 2.4: Payoff Function**
>
> A **payoff function** associates a number with each action in such a way that actions with higher numbers are preferred.

To model John's payoff function:

$$u(UCLA) > u(UCBerkeley) \tag{1}$$

The decision-maker's preferences conveys ordinal information not "how much".

2.3   Decision Problem

1. Choice of action

2. Your choice matters

3. You have goals

4. You are the only decision-maker

2.4   Game

In a game, its the same as above for 1-3 though 4 is:

4. You are not the only decision-maker

When the above holds, a *strategic situation* occurs.