# OR 3: Chapter 15 - Matching games

## Recap

In the [previous chapter](Chapter_15_Matching_games.html):

* We defined matching games;
* We described the Gale-Shapley algorithm;
* We proved certain results regarding the Gale-Shapley algorithm.

In this Chapter we'll take a look at another type of game.

## Cooperative Games

In cooperative game theory the interest lies with understanding how coalitions form in competitive situations.

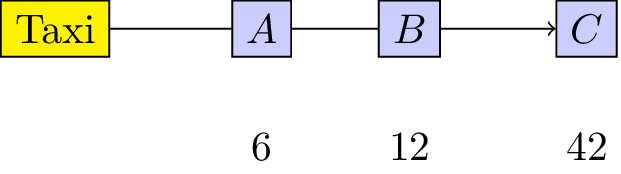
### Definition

A **characteristic function game** G is given by a pair where is the number of players and is a **characteristic function** which maps every coalition of players to a payoff.

Let's consider the following game:

"3 players must share a taxi. Here are the costs for each individual journey: - Player 1: 6 - Player 2: 12 - Player 3: 42 "

This is illustrated below:

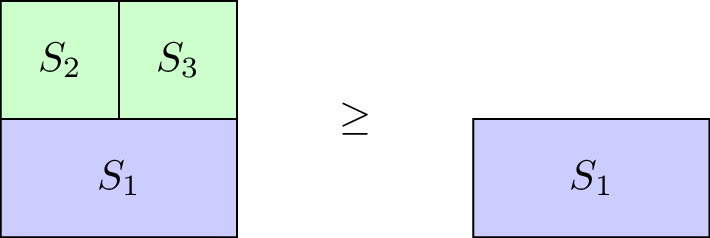


To construct the characteristic function we first obtain the power set (ie all possible coalitions) where denotes the set of all players ().

The characteristic function is given below:

### Definition

A characteristic function game is called **monotone** is it satisfies for all .

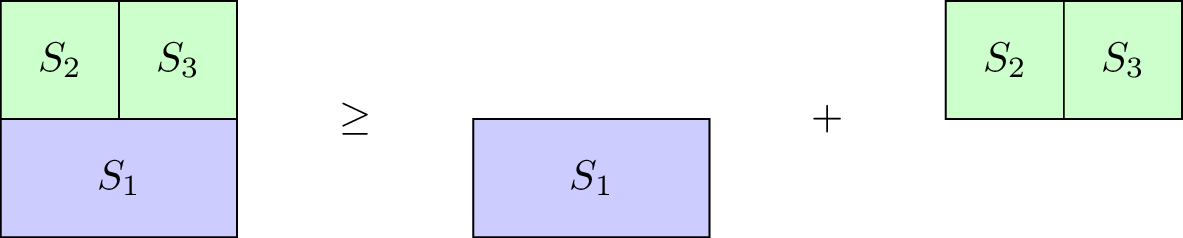


Our taxi example is monotone, however the with defined as:

is not.

### Definition

A characteristic function game is called **superadditive** if it satisfies



Our taxi example is not superadditive, however the with defined as:

is.

## Shapley Value

Solution concept Required properties Shapley value