

# When selfishness of agents meets the social optimum: solution of a congestion game

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## Abstract

We propose to solve a networking game, where each player has to choose a route, regarding congestion on the network. Two solutions of this problem are considered and compared: agents either selfishly choose their way, or they aim at minimizing the average length of time/cost.

The game is defined as follows: given a network represented by a weighted graph, we consider a population of agents wanting to move from one point to another (home to office), and therefore having to choose a route. Each of these paths takes a given time, depending on its weight, as well as the number of users on the edges. In this game, the transit time of an edge equals the proportion of individuals using it. To minimize the average travel time in the population, the agents would clearly not take the same route but dispatch on different ways according to the congestion degree on the available paths, which would lead to the social optimum in the best case. However, as agents are generally selfish, this might lead to a Nash-Wardrop equilibrium, where the agents do not necessarily choose the paths with the same proportions.

It is shown in our particular model that the two solutions coincide.