Computer Science > Information Theory

Coalitional Game Theory for Communication Networks: A Tutorial

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Game theoretical techniques have recently become prevalent in many engineering applications, notably in communications. With the emergence of cooperation as a new communication paradigm, and the need for self-organizing, decentralized, and autonomic networks, it has become imperative to seek suitable game theoretical tools that allow to analyze and study the behavior and interactions of the nodes in future communication networks. In this context, this tutorial introduces the concepts of cooperative game theory, namely coalitional games, and their potential applications in communication and wireless networks. For this purpose, we classify coalitional games into three categories: Canonical coalitional games, coalition formation games, and coalitional graph games. This new classification represents an application-oriented approach for understanding and analyzing coalitional games. For each class of coalitional games, we

present the fundamental components, introduce the key properties, mathematical techniques, and solution concepts, and describe the methodologies for applying these games in several applications drawn from the state-of-the-art research in communications. In a nutshell, this article constitutes a unified treatment of coalitional game theory tailored to the demands of communications and network engineers.

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