On applications of graph theory in game theory

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Abstract

An n player game Γ in strategic form consist of a set $I = \{1, \ldots, n\}$ of players, and for each player $i \in I$ a finite set A^i of actions and a payoff function $u^i : A^1 \times \cdots \times A^n$. We define the graph $G(\Gamma)$ to be the graph with vertex set I. Two vertices (players) i and j are connected by a directed edge from i to j if and only if player i's action can influence the payoff of player j. We consider a repeated play of Γ at discrete time intervalls $t = 1, 2, \ldots$. Initially, each player knows her set of actions but nothing else about the game. After the k'th play each player observes her realized action and the respective payoff but nothing about the other players' play. The main result is that the players can learn to play a pure Nash equilibrium, provided Γ has a pure Nash equilibrium, if the graph $G(\Gamma)$ is strongly connected.