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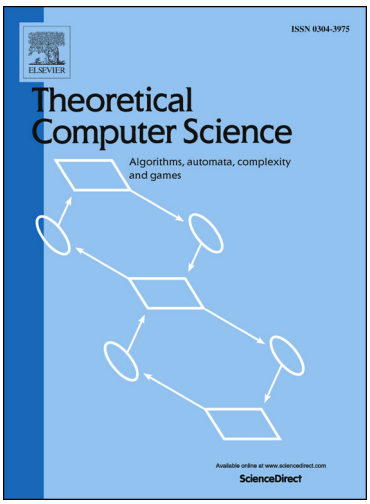

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Competitive Profit Maximization in Social Networks

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Abstract

We study the competitive profit maximization problem in a social network, which can be viewed as the profit maximization problem in a game-theoretic setting. We formulate two models called the profit maximization-agent (PM-A) game and the profit maximization-society (PM-S) game. By reducing them to be valid utility systems, we show that any Nash equilibrium provides an excepted social utility within a factor 1/2 (subject to a function-dependent additive term) of the optimum in the PM-A game and a factor of 1/2 of the optimum in the PM-S game. Furthermore, for the PM-S game, a polynomial-time algorithm is given for each player that can approximate the best response within a factor $(1 - 1/e)$.
Keywords: Social network; Profit maximization; Valid utility system; Nash equilibrium; Best response.

1 Introduction

Social networks have been widely used in the spread of information, innovations and products. Among numerous applications, the adoption of products based on "viral marketing" can be described as follows. Suppose that we intend to promote a new product in the market which can be modeled by a directed graph, where the nodes represent customers and the edges are interactions among them. Initially, we target a few influential customers called seed nodes and give them free samples of the product, i.e., we activate the seed nodes. These customers will recommend the product to their friends and some of their friends who adopt the product (called active nodes) will recommend to their own friends, and so on. Then how should we choose the initial seed nodes to make as many customers as possible adopt the product, that is, to maximize the number of active nodes when the process terminates?

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