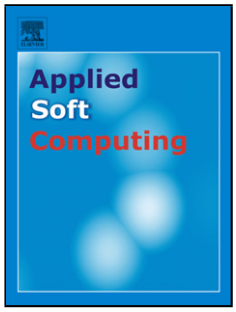

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How to make a best-seller: optimal product design problems

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Abstract

We formalize and analyze the computational complexity of three problems which are at the keystone of any marketing management process. Given the preferences of customers over the attribute values we may assign to our product (i.e. its possible features), the attribute values of products sold by our competitors, and which attribute values are available to each producer (due to e.g. technological limitations, legal issues, or availability of resources), we consider the following problems: (a) select the attributes of our product in such a way that the number of customers is maximized; (b) find out whether there is a feasible strategy guaranteeing that, at some point in the future before some deadline, we will reach a given average number of customers during some period of time; and (c) the same question as (b), though the number of steps before the deadline is restricted to be, at most, the number of attributes. We prove that these problems are Poly-APX-complete, EXPTIME-complete, and PSPACE-complete, respectively. After presenting these theoretical properties, heuristic methods based on genetic, swarm and minimax algorithms are proposed to suboptimally solve these problems. We report experimental results where these methods are applied to solve some artificially-designed problem instances, and next we present a case study, based on real data, where these algorithms are applied to a particular kind of product: We automatically design the *political platform* of a political party to maximize its numbers of votes in an election (problem (a)) and its number of supporters along time (problems (b) and (c)). The problem instances solved in this case study are constructed from publicly released polls on political tendencies in Spain.

Keywords: Marketing management, Product design, Computational complexity, Evolutionary computation, Heuristic methods, Non-cooperative Games

1. Introduction

Economics and Computer Science are significant sources of inspiration to solve the problems of each other. On the one hand, Computer Science has borrowed concepts

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