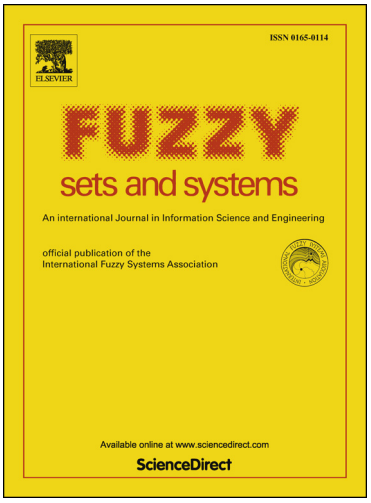
Accepted Manuscript



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PII: S0165-0114(17)30267-1
DOI: http://dx.doi.org/10.1016/j.fss.2017.06.005
Reference: FSS 7249

To appear in: *Fuzzy Sets and Systems*

Received date: 30 March 2016
Revised date: 9 June 2017
Accepted date: 12 June 2017

Please cite this article in press as: Q. Brabant, M. Couceiro, *k*-maxitive Sugeno integrals as aggregation models for ordinal preferences, *Fuzzy Sets Syst.* (2017), http://dx.doi.org/10.1016/j.fss.2017.06.005

k-maxitive Sugeno integrals as aggregation models for ordinal preferences

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Abstract

We consider an order variant of k-additivity, so-called k-maxitivity, and present an axiomatization of the class of k-maxitive Sugeno integrals over distributive lattices. To this goal, we characterize the class of lattice polynomial functions with degree at most k and show that k-maxitive Sugeno integrals coincide exactly with idempotent lattice polynomial functions whose degree is at most k. We also discuss the use of this parametrized notion in preference aggregation and learning. In particular, we address the question of determining optimal values of k through a case study on empirical data.

Keywords: Sugeno integral, k-maxitivity, lattice polynomial, degree, preference aggregation, preference learning

1. Introduction

The Sugeno integral was introduced in [30] and it became a widely used aggregation function in the qualitative approach to decision making since it provides a meaningful procedure to fuse values within universes where no structure (other than an order) is considered [6, 12, 18]. Originally, the Sugeno integral was defined over real intervals but it can be extended to wider domains, namely, distributive lattices, via the notion of lattice polynomial function (i.e., a combination of variables and constants using the lattice operations $\wedge$ and $\vee$). In fact, idempotent lattice polynomial functions coincide exactly with (discrete) Sugeno integrals (see e.g. [7, 25]). The latter observation is particularly interesting in the context of multicriteria decision making as it provides a way of aggregating preferences that are not total orders. In fact, preference aggregation in the qualitative approach to preference modeling is the problem that motivates the current paper, and that we now briefly discuss.