

Accepted Manuscript

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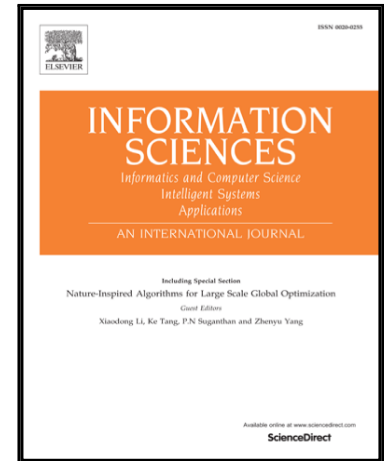
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PII: S0020-0255(16)31759-5
DOI: [10.1016/j.ins.2017.05.020](https://doi.org/10.1016/j.ins.2017.05.020)
Reference: INS 12890

To appear in: *Information Sciences*

Received date: 21 November 2016
Revised date: 6 May 2017
Accepted date: 12 May 2017

Please cite this article as: M.Nesibe Kesicioğlu, Ümit Ertuğrul, Funda Karaçal, An equivalence relation based on the U-partial order, *Information Sciences* (2017), doi: [10.1016/j.ins.2017.05.020](https://doi.org/10.1016/j.ins.2017.05.020)



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An equivalence relation based on the U-partial order

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Abstract

In this paper, an equivalence relation on the class of uninorms induced by the U-partial order is discussed. Defining the set of all incomparable elements w.r.t. the U-partial order, this set is deeply investigated and some relations with the sets of all incomparable elements w.r.t. the orders induced by the corresponding underlying t-norm and t-conorm are presented. Also, the set of all incomparable elements with a fixed element w.r.t. the U-partial order is defined and studied in detail.

Keywords:

Uninorm, Bounded lattice, Partial order, Equivalence of Uninorms

1. Introduction

Uninorms, firstly introduced on $[0, 1]$ by Yager and Rybalov [20], are one of the important operations generalizing the notions of t-norms and t-conorms [4, 21]. In the literature, the generalization of a uninorm defined on $[0, 1]$ to a bounded lattice has been an attractive problem for many researchers [3, 6, 10, 15, 18, 19], like the other logical operators, such as t-norm, t-conorms etc.

Recently, the order generating problem from a logical operator has been widely accepted by many researchers [9, 11, 13, 14]. In this sense, in [11], a partial order called as the T-partial order, induced by a t-norm has been introduced. In [13], an equivalence relation on the class of t-norms on a bounded lattice $(L, \leq, 0, 1)$ based on the equality of the induced T-partial orders has been defined. Also, in [13], the equivalence classes linked to some special t-norms have been characterized as well as some properties preserved by the introduced equivalence. Moreover, defining the set of all incomparable elements w.r.t. the T-partial orders, the set has been deeply investigated.

As a further work, in [5], an order, denoted by \leq_U , induced by uninorms on a bounded lattice has been introduced. Therefore, the order induced by t-norms on a bounded lattice has been extended to more general form. In this sense, to introduce an equivalence relation on the class of uninorms on a bounded lattice, to investigate the relation between the equivalence classes of uninorms, and the equivalence classes of their underlying t-norms and t-conorms have been mostly interesting problems.

In this paper, we introduce an equivalence on the class of uninorms on a bounded lattice $(L, \leq, 0, 1)$ based on the equality of the orders induced by uninorms. The main aim of this paper is to present the relations between the equivalence classes of uninorms and the equivalence classes of their underlying t-norms and t-conorms. The paper is organized as follows: In Section 2, we shortly recall some basic notions and results. In Section 3, we determine some relationships between the orders induced by t-norms and their N-dual t-conorms. Also, we present that for the equivalence of two t-norms on a bounded lattice, a necessary and sufficient condition is the equivalence of their N-dual t-conorms. In Section 4, we define an equivalence on the class of uninorms on a bounded lattice L with a neutral element e and we determine that two idempotent

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