Relations and Functions on Union-Soft Sets

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ABSTRACT

In this article, the theoretical aspects of union-soft sets by extending the notions of equivalence relations, partition, composition of relations, and function to the framework of union-soft sets are introduced. Further the Cartesian product, the relation between union-soft sets, induced relations from the universal set and the attribute set with examples are discussed. Moreover, the composition of union-soft set relationships with examples and some related theorems are demonstrated. Finally, the concepts of a union-soft set function and their respective composition function are examined.

KEYWORDS

Cartesian Products, Composition of Union-Soft Set Relations, Equivalence Relation, Partitions, Soft Sets, Union-Soft Set Functions, Union-Soft Set Relations, Union-Soft Sets

1. INTRODUCTION

Maji et al. (2002 & 2003) studied theoretical aspects of soft sets and investigated basic properties of soft sets theory. The notion of fuzzy soft sets, introduced by Maji (2001), which is a combination of Zadeh’s (1965) fuzzy sets and Molodtsov (1999 & 2004) soft sets, is very much useful to model the problems involving more parameter with uncertainty and ambiguity. Chen et al. (2005) presented a new notion of reduct soft set, and compared it with attributes reduction in rough set theory. Aktas & Cagman (2007) compared soft sets to the related concepts of fuzzy sets and rough sets. They also identify the notion of soft groups and derived some of the basic properties. Yang et al. (2008) extended soft set theory to fuzzy soft set theory by introducing fuzziness in parameters which is very much applicable to model the real-time problem involving more parameters. Irfan Ali et al. (2009) introduced some new notions such as the restricted intersection, the restricted union, the restricted difference and the extended intersection of two soft sets and established the famous De Morgan’s law for the defined operations. Kong et al. (2008 & 2009) studied a fuzzy soft set theoretic approach to decision making problems and further, the normal parameter reduction algorithm of soft sets is discussed.


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a fuzzy soft group was introduced by Aygunoglu & Aygun (2009) which was initiated by some binary operation on fuzzy soft set. Cagman & Enginoğlu (2010a, 2010b) redefined the operations of soft sets and established several new results. They also developed soft matrices which are representation of soft sets and studied some of their properties.

Jun et al. (2010) expressed the theoretical aspects of soft ordered semi groups and their algebraic structures. Majumdar & Samanta (2010b) deliberated an idea of soft mappings and studied the image of a set and soft set and their respective inverse images under the defined mapping. Gong Ke et al. (2010) suggested the concept of bijective soft set and introduced some basic operations on it. Feng et al. (2010 & 2011) projected the idea of soft rough sets, which can be seen as a generalized rough set model based on soft sets and presented important properties of soft rough approximations based on soft approximation spaces. Further they were suggested new kinds of soft sets and discussed the soft rough equal relations. Roy & Samanta (2012) gave the notions of fuzzy soft topological spaces and its algebraic structures. Babitha & Sunil (2013) introduced soft multi sets and their application in decision making problems. Ma & Zhan (2013) conversed the characterizations of three kinds of hemi rings by fuzzy soft h-ideals. Jun et al. (2013) presented the Inter-sectional soft sets and application to BCK/BCI algebras. Zhan & Cristea (2014) discussed characterizations of fuzzy soft $T$-hemi rings and its properties. Naz & Shabir (2014a, 2014b) deliberated the algebraic structures of fuzzy bipolar soft sets and soft semi hyper groups. Recently, Haci Aktas (2015) studied some algebraic applications of soft sets in various fields. Many researchers like, Alkhazaleh et al. (2011), Roy et al. (2007), and Xu et al. (2010) are attracted by the concept of fuzzy soft sets and they have developed new notions of fuzzy soft sets and applied them in many fields of science and technology, economics, medical sciences, etc.

1.1. Scope and Motivation

The aim of this paper is to lay groundwork for providing a union-soft algebraic tool for considering many problems that contain uncertainties. Babitha & Sunil (2010) introduced the concept of soft set relation and function and discussed many related concepts such as the equivalence soft set relation, partition of soft sets, ordering on soft sets. In extension of their work, they worked on soft set relation and ordering by introducing the concept of anti-symmetric relation and transitive closure of a soft set relation. Yang & Guo (2011) introduced the notions of anti-symmetric closure of a soft set relation and obtained with proofs some results involving them. Sezgin & Atagun (2011), also introduced the restricted symmetric difference of soft sets and investigated its properties with examples. Singh & Onyeozili (2012) obtained some results on distributive and absorption properties with respect to various operations on soft sets and also, they established the operations defined on soft sets are equivalent to the corresponding operations defined on their soft matrices. Based on these motivations, the concepts of a union-soft set relation and function and also their respective composition function are studied.

1.2. Proposed Work

This paper deals with the theoretical aspects of union soft sets by introducing equivalence relation, partitions, composition of relations among union-soft sets. Further, some of the basic properties of the union-soft sets are investigated. Finally, the properties of a union-soft set function and their respective composition function are examined. The diagrammatic representation of this paper (Figure 1) is given below.

2. PRELIMINARIES

Definition 2.1 (Molodtsov, 1999) Let $U$ be an initial universe set and $E$ is a set of parameters. Let $P(U)$ denote the power set of $U$. Let $A \subseteq E$. A pair $(F, A)$ is called a soft set (over $U$) if and only if $F$ is a mapping of $E$ into the set of all subsets of the set $U$. 

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