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VARIOUS TYPES OF PRODUCTS ON HESITANT FUZZY GRAPHS

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Abstract

The most appreciate theory to deal with uncertainties is Fuzzy set theory. Recently, a new extension of fuzzy sets so-called Hesitant Fuzzy sets has been introduced to deal with hesitant situations. In this paper, we characterize three operations on Hesitant fuzzy graphs, viz. direct product, semi-strong product and strong product. In addition, we investigated many interesting results regarding the operations. Finally, we defined product Hesitant fuzzy graphs and find many interesting results.

Introduction

Graph theory has applications in many areas of computer science, including data mining, image segmentation, clustering, image capturing, and networking.

Many of the real world problems are very complex and full of unclear information. Rosenfeld [4] developed fuzzy graphs. Torra [2] introduced a new extension of fuzzy sets called Hesitant Fuzzy Sets to handle the common difficulty that appears in fixing the membership degree of an element from some possible values which leads to a growth of many concepts. Hesitancy Fuzzy Graphs (HFGs) was introduced by Pathinathan. T et. al in [7]. Also expresses the various introductory concepts of Hesitancy Fuzzy Graphs with suitable illustrations. Ramaswamy and Poornima [5] discussed product fuzzy graphs. Sankar Sahoo, Madhumangal Pal[9] discussed about the various types of product on intuituionstic fuzzy graph.

In this paper, we characterize three operations on Hesitant fuzzy graphs, viz. direct product, semi-strong product and strong product. In addition, we introduces Various types of hesitancy fuzzy graph. Based on the definition of hesitant fuzzy graph, Operations like complement, join, union, intersection, ringsum are defined for hesitant fuzzy graphs. The authors further proposed to apply these operations in clustering techniques.

II Preliminaries

In this part, we assessment some elementary concepts whose understanding is necessary for full benefit from this paper.

By a graph we mean a pair $G = (V, E)$, where V is the set and E is a relation on V. The elements of V are vertices of G and the elements of E are edges of G. We write $xy \in E$ to mean $(x, y) \in E$, and if $e = xy \in E$, we say x and y are adjacent. The number of vertices, the cardinality of V, is called the order of graph and denoted by $|V|$. The number of edges, the cardinality of E, is called the size of graph and denoted by $|E|$.

Let $G_1=(V_1, E_1)$ and $G_2=(V_2, E_2)$ be two simple graphs. Next, the direct product of G_1 and G_2 is a graph $G_1 \sqcap G_2= (V, E)$ with $V=V_1 x V_2$and $E= \{((u_1,v_1),(u_2,v_2)) / (u_1,u_2) \in E_1,(v_1,v_2) \in E_2\}$. The union of graphs G_1 and G_2 is defined as $G_1 \cup G_2= (V_1 \cup V_2, E_1 \cup E_2)$ and join is the simple graph $G_1+G_2 =(V_1 \cup V_2, E_1 \cup E_2 \cup E')$, where E' is the set of all edges joining the vertices of V_1 and V_2, also assume that $V_1 \cap V_2 = \phi$.