Chapter 5

Dominations in Neutrosophic Graphs

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ABSTRACT

The aim of this chapter is to impart the importance of domination in various real-life situations when indeterminacy occurs. Domination in graph theory plays an important role in modeling and optimization of computer and telecommunication networks, transportation networks, ad hoc networks and scheduling problems, molecular physics, etc. Also, there are many applications of domination in fuzzy and intuitionistic fuzzy sets for solving problems in vague situations. Domination in neutrosophic graph is introduced in this chapter for handling the situations in case of indeterminacy. Dominating set, minimal dominating set, independent dominating set, and domination number in neutrosophic graph are determined. Some definitions, characterization of independent dominating sets, and theorems of neutrosophic graph are also developed in this chapter.

1. INTRODUCTION

Graph theory plays a vital role in applied mathematics. Many real-world situations can be described by means of a diagram consisting of a set of points together with lines joining certain pairs of these points. For example, the points could represent people, with lines joining pairs of friends; or the points might be communication centres, with lines representing communication links. A mathematical abstraction of situations of this type gives rise to the concept of a graph (J. A. Bondy & U. S.
R. Murty.,(1976)). Definition of fuzzy graph was proposed by Katmann by using the fuzzy relations introduced in (Zadeh, 1965). In (Rosenfield, 2010) another definition with fuzzy vertex and fuzzy edges and several concepts in graph theory such as paths and cycles etc., were introduced. Mathematical study of domination in graphs began around 1960. The terms “dominating set” and “domination number” were introduced in the book on graph theory by (Oystein Ore,1962). The problems described above were studied in more detail in (Yaglom and Yaglom, 1964). Solutions to some of these problems for rooks, knights, kings, and bishops were resulted by their study. In (Cockayne and Hedetniemi, 1977), the notation $\gamma(G)$ was first used for the domination number of a graph G. Also, the edge domination and its applications are presented in (Arumugam and Velammal, 1998 & Chang, 1998). In (Somasundaram and Somasundaram, 1998) domination in fuzzy set was investigated. The concept of independent domination in fuzzy graph is discussed in (Jayalakshmi et al.2014; Karunambigai et al., 2015). The concept of strong (weak) domination and total domination were developed by applying the domination in fuzzy graph in (A. Nagoor Gani et al, 2010). In (Atanassov, 1986) the concept of intuitionistic fuzzy set as a generalization of fuzzy sets was introduced. Definition of intuitionistic fuzzy graphs, intuitionistic hypergraph, intuitionistic digraphs and its applications, completeness, tolerance, degree structures and various operations in intuitionistic fuzzy graph were discussed in (Nagoor Gani et al, 2010). In Parvathi and Thamizhendhi(2010), dominating set, independent dominating set, domination number and total domination in intuitionistic fuzzy graph were introduced. Different types of domination in intuitionistic graph were investigated by many researchers in (Karunambigai et al., 2010, Nagoor Gani and Latha, 2012, Nagoorgani and Prasanna Devi, 2013, R. Parvathi and Karunambigai, 2006; Sahoo and Pal, 2016 & 2017). Neutrosophic set proposed by Smarandache (2006) is a powerful tool for dealing problems involving imprecise, inconsistant data and indeterminacy in the real world. It is the generalization of fuzzy sets and intuitionistic fuzzy sets. The results obtained from any application by using neutrosophic graphs will be better than by fuzzy graphs and intuitionistic fuzzy graphs, since indeterminacy membership function is used in neutrosophic graphs additionally. Fuzzy graph and intuitionistic fuzzy graph approaches are failed in some applications when indeterminacy occurs. So Smarandache (2011 & 2015) defined four main categories of neutrosophic graphs. In this chapter, certain types of domination in neutrosophic graph are developed and some theorems are explored.
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