Some Application Of Domination In Graph

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Abstract:

Domination in graphs has applications to several fields. Domination arises in facility location problems, where the number of facilities (e.g., hospitals, fire stations) is fixed and one attempts to minimize the distance that a person needs to travel to get to the closest facility. A similar problem occurs when the maximum distance to a facility is fixed and one attempts to minimize the number of facilities necessary so that everyone is serviced. Concepts from domination also appear in problems involving finding sets of representatives, in monitoring communication or electrical networks, and in land surveying (e.g., minimizing the number of places a surveyor must stand in order to take height measurements for an entire region).

Key Words: *Domination set, Networking, Biological networks, Minimal Dominating set.*

Introduction:

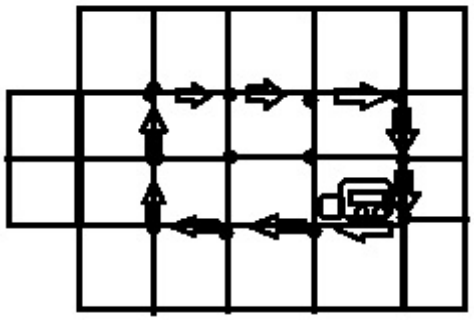
Domination in graphs has been extensively researched branch of graph theory. Graph theory is one of the most flourishing branches of modern mathematics. The last 30 years have with one and spectacular growth of graph theory due to its wide application to discrete optimization problems, combinatorial problems and classical algebraic problem. It has wide range of physical, social and biological sciences; linguistic etc, the theory of domination has been the nucleus of research activity in graph theory in recent times. This is largely due to the variety of new parameters that can be developed from the basic definition of domination.

The rigorous study of dominating set in graph theory began around 1960, even though the subject has historical roots dating back to 1862 when de jaenisch studies the problem of determining the minimum number of queens which is necessary to cover or dominate an nxn chessboard. In 1958,berge defined the concept of domination number of a graph, calling this as “coefficient of external stability”. In 1962,ore used the name ”dominating set” and domination number for the same concept. In 1977 cockayne and extensive survey of results know at that time about dominating set in graph. They have used the notation (G) for the domination number of graph, which has become very popular since then. The survey paper of cockayne and hedetnieme has generated a lot of interest in study of domination in graphs .In a span about twenty years after the survey more than 1200 research papers have been published on this topic. In this chapters describes about domination insets, more about varieties of domination, common minimal domination etc. and theorems, results related to it and application of domination in graphs.

School bus routing:

Most school in the country provide school buses for transporting children to and from school Most also operate under certain rules, one of which usually states that no child shall have to walk farther than, say one quarter km to a bus pickup point. Thus, they must construct a route for each bus that gets within one quarter km of every child in its assigned area. No bus ride can take more than some specified number of minutes, and Limits on the number of children that a bus can carry at any one time. Let us say that the following figure represents a street map of part of

a city, where each edge represents one pick up block. The school is located at the large vertex. Let us assume that the school has decided that no child shall have to walk more than two blocks in order to be picked up by a school bus. Construct a route for a school bus that leaves the school, gets within two blocks of every child and returns to the school.



Locating radar stations problem:

The problem was discussed by Berge. A number of strategic locations are to be kept under surveillance. The goal is to locate a radar for the surveillance at as few of these locations as possible. How a set of locations in which the radar stations are to be placed can be determined

Nuclear power plants problem:

Z similar known problem is a nuclear power plants problem. There are various locations and an arc can be drawn from location x to location y if it is possible for a watchman stationed at x to observe a warning light located at y. How many guards are needed to observe all of the warning lights, and where should they be located? At present, domination is considered to be one of the fundamental concepts in graph theory and its various applications to ad hoc networks, biological networks, distributed computing, social networks and web graphs [1, 25, 27, 47] partly explain the increased interest. Such applications usually aim to select a subset of nodes that will provide some definite service such that every node in the network is close to some node in the subset. The following examples show when the concept of domination can be applied in modeling real-life problems

Modeling biological networks:

Using graph theory as a modeling tool in biological networks allows the utilization of the most graphical invariants in such a way that it is possible to identify secondary RNA (Ribonucleic acid) motifs numerically. Those graphical invariants are variations of the domination number of a graph. The results of the research carried out in show that the variations of the domination number can be used for correctly distinguishing among the trees that represent native structures and those that are not likely candidates to represent RNA.

Modeling social networks:

Dominating sets can be used in modeling social networks and studying the dynamics of relations among numerous individuals in different domains.

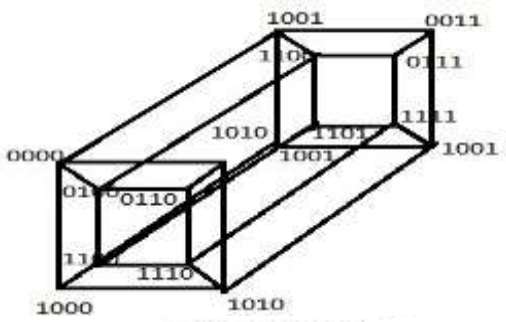
A social network is a social structure made of individuals (or groups of individuals), which are connected by one or more specific types of interdependency. The choice of initial sets of target individuals is an important problem in the theory of social networks. In the work of Kelleher and Cozzens, social networks are modeled in terms of graph theory and it was shown that some of these sets can be found by using the properties of dominating sets in graphs.

Facility location problem:

The dominating sets in graphs are natural models for facility location problems in operational research. Facility location problems are concerned with the location of one or more facilities in a way that optimizes a certain objective such as minimizing transportation cost, providing equitable service to customers and capturing the largest market share.

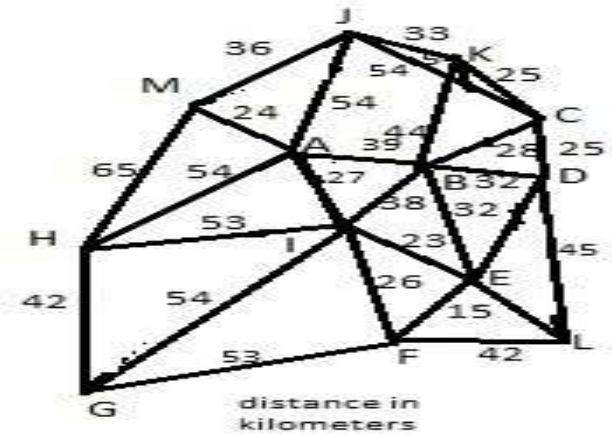
Computer communication network:

Consider a computer network modeled by a graph G = (V,E), for which vertices represents computers and edges represent direct links between pairs of computers. Let the vertices in following figure represent an array, or network, of 16 computers, or processors. Each processor to which it is directly connected. Assume that from time to time we need to collect information from all processors. We do this by having each processor route its information to one of a small set of collecting processors (a dominating set). Since this must be done relatively fast, we cannot route this information over too long a path. Thus we identify a small set of processors which are close to all other processors. Let us say that we will tolerate at most a two unit delay between the time a processor sends its information and the time it arrives at a nearby collector. In this case we seek a distance-2 dominating set among the set of all processors. The two shaded vertices form a distance-2 dominating set in the hypercube network in following figure

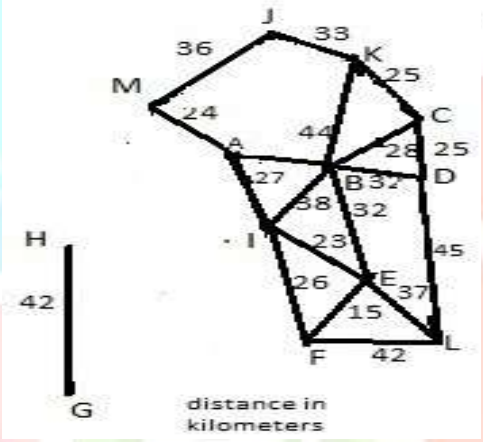


Radio stations:

Suppose that we have a collection of small villages in a remote part of the world. We would like to locate radio stations in some of these villages so that messages can be broadcast to all of the villages in the region. Since each radio station has a limited broadcasting range, we must use several stations to reach all villages. But since radio stations are costly, we want to locate as few as possible which can reach all other villages. Let each village be represented by a vertex. An edge between two villages is labeled with the distance, say in kilometers, between the two villages



Let us assume that a radio station has a broadcast range of fifty kilometers. What is the least number of stations in a set which dominates within distance 50 all other vertices in this graph? A set B,F,H,J of cardinality four is indicated in the following figure 2



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Here we have assumed that a radio station has a broadcast range of only fifty kilometers, we can essentially remove all edges in the graph, which represent. a distance of more than fifty kilometers. We need only to find a dominating set in this graph. Notice that if we could afford radio stations which have a broadcast range of seventy kilometers, three radio stations would sufficient.

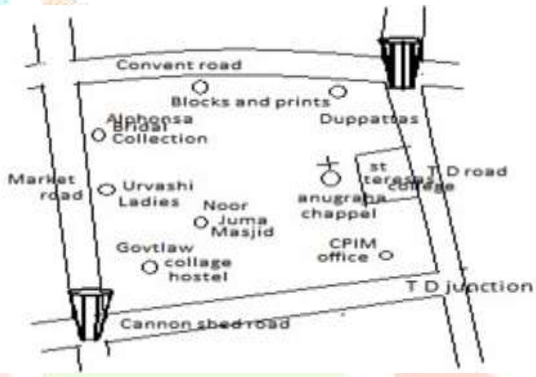
Coding theory:

The concept of domination is also applied in coding theory as discussed by Kalb fleisch, Stanton and Horton and Cockayne and Hedetniemi . If one defines a graph, the vertices of which are the n-dimensional vectors with coordinates chosen from 1,..., p, p > 1, and two vertices are adjacent if they differ in one coordinate, then the sets of vectors which are (n, p)covering sets, single error correcting codes, or perfect covering sets are all dominating sets of the graph with determined additional properties.

Multiple domination problem:

An important role is played by multiple domination. Multiple domination can be used to construct hierarchical overlay networks in peer-to-peer applications for more efficient index searching. The hierarchical overlay networks usually serve as distributed databases for index searching, e.g. in modern file sharing and instant messaging computer network applications. Dominating sets of several kinds are used for balancing efficiency and fault tolerance as well as in the distributed construction of minimum spanning trees. Another good example of direct, important and quickly developing applications of multiple domination in modern computer networks is a wireless sensor network.

? How many waste bins can be placed to reduce pollution in given map (convent junction)?



Two waste bins can be placed in order to reduce pollution.

Conclusion:

The main aim of this project is to present the importance of graph theoretical ideas in various areas oa science and engineering for domination in graphs theoretical concepts for the research. An overview is presented especially to project the idea of graph theory. so, the graph theory section of each paper is given importance than to other sections. Researches may get some information related to graph theory and its application some ideas related to their research field.

In graph theory, there are many stability parameters such as vertex domination number, independence number etc. The domination number of a graph is a new vulnerability measure that considers the neighborhood of vertices. From the definition of domination, ever vertex of a graph must be protected by its neigbourhood. In this search, the main ideas is each u,vϵV must be protected and are capable of dominating of both u and v also we discussed about total domination, independent domination,(1,2) domination in detail and also discussed varieties of domination and application of domination in different fields.

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