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RECENT ADVANCES IN GRAPH THEORY AND ITS APPLICATIONS

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ABSTRACT. In different fields the field of mathematics plays a key role. In mathematics, graph theory is one of the important fields used in structural models. This structural structure of different objects or technologies leads to new developments and changes in the current world in these areas. The field graph theory began in 1735 with the Koinsberg Bridge problem. This paper provides a description of implementations of graphical theory in a number of heterogeneous areas but focuses mostly on information science, electrical engineering, linguistics, physics and chemistry, computer network science, biotechnology and graphical theoretical applications. Several articles focused on graph theory have been studied concerning scheduling principles, engineering technology implementations and an outline.

1. INTRODUCTION

A diagram consisting of many points and lines that unite several pairs of these points can be easily represented for several real-world contexts. The points might, for example, show individuals with lines who join couples with friends; or the points could be contact centers with lines showing connection connections. Notice that one is primarily concerned in such diagrams whether a line

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connects two defined points or not; the way they are connected is immaterial. The definition of a graph is a statistical abstraction of conditions of this kind.Graph theory principles are commonly used in various fields to research and model different applications. This includes studying molecules, building chemical bonds and studying atoms. In sociology, for instance, graph theory is used to calculate the popularity of actors or to investigate processes of diffusion. The theory of graphs is used for biodiversity and conservation, where a vertex represents areas in which some species live and where edges represent migratory or moving paths between areas. This data is important for examining the breeding habits of disease, parasites and for investigating the effect of migration on other animals. This knowledge is important. In the field of computer science, graph theory concepts are widely used [1]. The graph theory uses algorithms such as Breadth First Search, Depth First Search, Topological Sort, Bellman-Ford, the algorithme of Dijkstra, Minimum Trees, the Algorithm of Kruskal and the Prim's.

2. History of Graph theory

The root of the graphic principle began with the Koinsber bridge dilemma in 1735. This dilemma leads to the Eulerian graph principle. Euler analyzed the Koinsberg Bridge problem and created a structure to solve the problem known as the Eulerian graph. A.F Mobius offered the concept of a total graph and a bipartisan graph in 1840, and Kuratowski showed that they were planar of leisure problems. The principle of tree (Gustav Kirchhoff introduced a linked graph without cycles in 1845 and used graphical technical concepts for the measurement of current in electrical networks or circuits. In 1852, the popular four-color issue was discovered by Thomas Gutherie. Then in 1856, Thomas, P. Kirkman and William Hamilton, researched polyhydra cycles and developed, by observing trips which visited a number of locations exactly once, the idea called the Hamiltonian graph. In 1913, H. Dudeney spoke about an issue of puzzles. Eventually, Kenneth Appel and Wolfgang Haken addressed the four-color dilemma only after a century. This period the birth of graph theory is considered [2]. To research the trees Caley learned specific analytical forms from the differential calculus. And has several consequences for theoretical chemistry. This leads to enumerative graph theory being invented. Anyway, in 1878, Sylvester introduced "Graph," where he drew an analogy from "quantum invariants" to

algebra and molecular-diagram covariants [3]. In 1941 Ramsey experimented on the colours, leading to the identification of a subset of graphic science named severe graphic theory. In 1969, Heinrich's computers solved the four-color mystery. The analysis of asymptotic graph connectivity has led to a random principle of graphics.

3. Applications of Graph Theory

Graph theory principles are commonly utilized in diverse fields to research and model different applications. This includes studying compounds, building bonds in chemistry and studying atoms. In sociology, graph theory is similarly used for example to calculate the popularity of performers or to investigate processes of diffusion. Graphic theory is used in biology and conservation where the vertex describes the areas in which animals occur and the edges reflect the direction of migration or travel through regions. This knowledge is critical for examining breeding trends or monitoring the propagation of diseases and parasites and for investigating the effect of migration on other animals[4,5]. Theoretical graphic principles are commonly utilized in research operations. For example the dilemma of the tour sales person, the shortest stretch in a weighted graph, obtains optimal work and men match and finds the shortest route from two vertices in a diagram. It is also used for modelling transport networks, networks of operation and game theory[6]. A digraph is used to describe the finite game method. The vertices here mark the locations and the edges represent the movements. Graph theory is widely employed in research and technology. Any of the following are given:

3.1. **Computer Science.** For the analysis of algorithms such as: Dijkstra Algorithm, Prims Algorithm, Kruskal Algorithm theory is used in computer graphics. Anwendungsbereiche such as Graphs are used to describe the calculation flow. Graphs are used to portray contact networks. Graphs reflect the organization of results. Graph transformation schemes operate on the manipulation of graphs on the basis of rules. Graph databases ensure secure, continuous storage and querying of organized graph data. Graph theory is used for finding the shortest route or network direction. Google Maps shows different places as vertices or points, and the roads are seen as corners and the idea of the chart is used to find the shortest path between two nodes.

3.2. **Electrical Engineering.** Graph theory is used in electrical engineering in the construction of circuit links. This relations are referred to as topologies. Certain topologies include sequence, bridge, star and parallel topologies.

3.3. **Linguistics.** Graphs are mostly used for the parsing of a language tree and a language tree grammar in linguistics. In lexical semantitics the semantitic networks are used, particularly for computers, and the modelization of word sense is simpler when a word is interpreted in relation to the word. Phonological methods (e.g. optimal theory that is based on grid diagrams) and morphology (e.g. finite state morphology utilizing finite-state transducers) are popular in linguistic research as a diagram.

3.4. **Physics and Chemistry.** Chemistry graphs are used to model chemical compounds. Any sequences of cell samples may be omitted in statistical biochemistry in order to overcome contradictions between two sequences. This is modelled as a graph in which the vertices reflect the sample sequences. An edge is drawn between two vertices where there is a conflict between the sequences. The goal is to delete potential vertices (sequences) in order to remove all disputes. In short, graphic theory has a special influence in several areas and is already spreading over many days. The following section analyzes the uses of graph theory in computational sciences in particular. Chart theory is used in physics and chemistry to analyze molecules. The 3D layout of complex artificial atomic systems can be quantitatively analyzed by collecting statistics on graph-theoretical features in relation to atom topology. Graphs are also used in statistical mechanics. In this area, diagrams may describe local relations between the interacting sections of a system and the physical process dynamics on those structures. Graphs also express porous media micro channels in which the vertices reflect the pores and the borders represent the smaller pores. Graph is also useful in building both the molecular structure and the molecular grid. It also allows us to demonstrate the connection between atoms and molecules and helps us to compare the structure of a molecule with another.

3.5. **Computer Network.** The ties between linked computers in the network obey the concepts of graph theory in the computer network. Graph theory is often used for protection of the network. We will use the vertex coloring algorithm to paint the map in four colours. Vertex Coloring Algorithm may be used

to delegate a maximum of four distinct frequencies to any mobile network GSM (Grouped Special Mobile).

3.6. **Social Sciences.** In sociology, graph theory is also used. For example, to explore the dissemination of rumor or to calculate the credibility of actors by the use of tools for social network analysis. Friendship and knowledge graphs describe whether or not individuals meet one another. Some individuals may affect the behavior of others in influential diagrams. In collaborative graphs model, two individuals operate together in a similar context, for example participating in a film together.

3.7. **Biology.** Nodes in biological networks are bimolecular such as chromosomes, proteins or metabolites and edges that link the nodes signify interactive, physical or chemical interactions between the bimolecular concerned. In transcriptional regulatory networks, graph theory is used. It is seen in metabolic networks as well. Graph theory is also useful in PPI (protein interaction) networks. Characterizing drug goal partnerships. drug target interactions.

3.8. **Mathematics.** Operational analysis is the essential area of mathematics. Graph theory offers numerous practical organizational analysis uses. Like: Minimum route expenses, A issue with the schedule. Graphs reflect the roads between the towns. We may construct hierarchically organized details such as a family tree with the aid of a sort of graph.

4. Conclusion

Programmers and designers, graph theory is an extraordinarily rich field. Graphs can help solve some very complicated issues, such as lower costs, visualization, program analysis, etc. To calculate an optimum traffic routing, network devices, such as routers and switches use graphics. This paper focuses mainly on presenting the recent developments in the field of graph theory and its various applications in the field of engineering. In particular, the concept of graph theory is outlined in an overview. Researchers in different streams, such as engineering, social science, general sciences etc., benefit from this. There is a wide discussion of each domain application, which is very beneficial to any researchers.

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