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RESEARCH ARTICLE

Graph Theory and its Application in Social Networking

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ABSTRACT

Social networking system is an online service, platform that focuses facilitating the building of social relations among people who, for exam share interests, activities, backgrounds, or real-life connections. In this pa gives an overview of the applications of graph theory in social networking focus on computer science discipline applications that uses graph theoret concepts.

Keywords: Social network, Graph theory, vertex & Edges, Graph coloring application.

INTRODUCTION

Graph theory was started with Leonhard Euler in his study about the problem in Bridges of Konigsburg. Konigsburg now named as Kaliningrad. In the Koningsburg, four regions are connected by the seven bridges. The people while travelling across all the seven bridges and reach their starting point by crossing the each bridge two times. The Konigsburg bridge problem was solved by the Euler in 1735. Since Euler first solved the graph theory's problem and it is known as an Eulerian graph.

He is well known for his work in optics, asteroid, mechanics and astronomy was named to honor him (Deo, 1990 & Wang 1988). Graph theory is also a major tool in the research of mathematics, computer networking, business administration, electrical engineering, economics, communications and the sociology. The connected graph without cycles i.e. the concept of tree was found out by Kirchhoff, 1845 and he also implemented the ideas on the graph theory in the calculating the currents in the field of electrical circuits or networks. (Elevator 2007, West 1996 and Social networking service 2014).

Some Basic definition:

a. Definition: A Graph or a general Graph

A Graph (G) or a general Graph (G) consists of a nonempty finite set V (G) together with a family E(G) of unordered pairs of element (not necessarily distinct) of the set. We may write G = (V (G), E (G)).

b. Definition:- Vertices & Edges

If G = (V(G) , E(G)) is a graph then the set V(G) is said to be the vertex set of the Graph G and the member of V(G) are said to be the Vertices of the Graph. The family E (G) is said to be the age family of the graph (G) and the members of E (G) are said to be the edges of the Graph G.

c. Definition:- A Simple Graph

The Graph (G) consists of a nonempty finite set V (G) with a set E(G) of unordered pairs of distinct element of the set V(G) is said to be simple graph .We may write G = (V (G), E (G)).

d. Definition:- A walk

A walk in a graph G is a finite sequence of edges of the form v_0v_1, v_1v_2, v_2v_3. . . $\mathbf{V_{n-1}}v_n$. Also denoted by v_0 E v_1 E v_2 E . . . E v_{n-1} E v_n, in which any two consecutive edges are adjacent or identical. Such a walk determines a sequence of vertices v_0, v_1, v_2, . . . , v_{n-1}, and v_n. (Here two consecutive vertices are adjacent or identical).

Here v_0 is said to be initial vertex of the walk & v_m is said to be the terminal vertex of the walk.

e. Definition: - Trail

If all the edges in a walk are distinct then such a graph is said to be a Trail.

f. Definition: - Path

If all the vertices v_0, v_1, v_2. . . v_n in a trail are distinct (except possibly $v_0 = v_n$) then such a trail is said to be a path.

g. Definition: -

A walk or a Trail or a Path is said to be a close if initial vertex & the final vertex are identical

h. Definition:

A connected Graph: A Graph not to be expressed as the union of two graphs is called connected graph.

***History of Graph theory**:*

The problem of Koinsber bridge is the root of the graph theory in 1735 which lead to the concept of Eulerian Graph. Studying the problem of koinsber bridge by Euler constructed a structure which is to be used to solve the problem of Eulerian graph. In 1840, A.F Mobius coin the idea of complete graph and bipartite graph and Kuratowski shown that they are planar by means of recreational problems. The idea of tree, a connected graph without cycles (Deo, 1990) was implemented by Gustav Kirchhoff in 1845, and he employed graph theoretical ideas in the analysis of currents in electrical networks. In 1852, Thomas Gutherie noticed the famous four color problem. The concept of graph theory was invented by studying trips which are exactly once during study of polyhydra. (Thomas and William, 1856). Dudeney (1913) observed a puzzle problem. Even though the four color problem was invented much earlier, but it was solved only after a century by Kenneth Appel and Wolfgang Haken. This time is considered as the birth of Graph Theory (Gaudin and Barba,1991 and Coffman *et al.,* 1985).

Caley studied particular analytical forms to study the tree from differential calculus. This is useful to invent enumerative graph theory in theoretical chemistry. The term "Graph" was introduced by Sylvester in 1878 by drawing an analogy "Quantico invariants" and covariant of algebra and molecular diagrams. Ramsey's work in 1941, on colorations lead to the identification of graph theory called extremel graph theory. In 1969, the four color problem was solved Heinrichby by using computer. The rise of random graph theory is seen in the study of asymptotic graph connectivity (Gross and Yellen, 1998).

Applications of Graph theory:

Graph theoretical concepts are mostly used to study and model is used in different applications in various areas. They include construction of bond in the field of chemistry .study of molecules, study of atoms. Graph theory is used in sociology, Example to explore the mechanisms in diffusion and actor prestige can be measured. Graph theory is used in biology and the efforts conservation where a vertex denotes the regions in that certain species exist and then the edges denotes movement or migration path and between the regions. This information is significant when seeing the breeding pattern or finding the spread of parasites. Also graph theoretical concepts are mostly used in the field of Operations Research. Example, in the operation research the weighted graph finding a shortest spanning tree, traveling salesman problem, getting optimal match of men and job and in graph it locating the shortest path between two vertices. Graph theory is also used in the theory of games, modeling transport networks and activity networks. By using network activity large number of combinatorial problems would be solve. in Operational research Scheduling and planning of large complicated projects is the most popular and successful applications of networking. The well known problems are Critical Path (CPM) and Project Evaluation Review Technique (PERT) method. Graph theory is very useful to find optimal way to perform certain task in competitive in the field engineering, economics and war science to identify

optimal way to perform certain tasks in competitive surrounding. To represent the method of finite game a digraph is used. In Game theory the vertices denotes the positions and the edges represent the moves

a. Graphs in Chemistry:

The graph is used in the field for modeling the chemical compound. In biochemistry computational some sequences of cell samples have to be avoided to resolve the conflicts among two sequences. This is designed in the graph form where the vertices denote the sequences in the sample. An edge will be drawn between two vertices if and only if there is a conflict among the corresponding sequences. The main aim is to eliminate the possible vertices, (sequences) to remove all conflicts. In short, graph theory has its unique effect in different fields and is growing large day by days. The subsequent section analyses the applications of graph theory particularly in computer science.

b. Algorithms and graph theory:

The most important role of graph theory in computer applications is the development of graph algorithms. Many algorithms are used to solve problems that are modeled in the form of graphs. These algorithms are used to solve the graph theoretical concepts which intern used to solve the computer science application problems.

List of algorithms are as follows:

1. Finding a minimum spanning tree
2. Finding graph planarity
3. Shortest path algorithm in network
4. Algorithms to find the cycles in a graph..
5. Algorithms to find the connectedness
6. Algorithms to find the adjacency matrix
7. Algorithms for searching an element in a data structure (DFS, BFS).

The computer languages are used to support the graph theory concepts. The main goal of such languages is to enable the user to formulate operations on graphs in a compact form.

Graph theory languages are as follows:

1. SPANTREE – is to find a spanning tree in the given graph.
2. GTPL – Graph Theoretic Language
3. GASP – Graph Algorithm Software Package
4. HINT – Extension of LISP
5. GRASPE – Extension of LISP
6. IGTS – Extension of FORTRAN
7. GEA – Graphic Extended ALGOL (Extension of ALGOL)
8. AMBIT – To manipulate digraphs
9. GIRL – Graph Information Retrieval Language
10. DENTRAL – To identify the chemical compound.

APPLICATIONS OF GRAPH COLORING

a. Guarding an Art Gallery

The application of Graph Coloring is used in guarding an art gallery. Art galleries therefore have to guard their collections carefully. During the day the attendants can keep a look-out, but at night this has to be done by video cameras. These cameras are usually hung from the ceiling and they rotate about a vertical axis. The images from the cameras are sent to TV screens in the office of the night watch. Because it is easier to keep an eye on few TV screens rather than on many, the number of cameras should be as small as possible. An additional advantage of a small number of cameras is that the cost of the security system will be lower. On the other hand we cannot have too few cameras, because every part of the gallery must be visible to at least one of them. So we should place the cameras at strategic positions, such that each of them guards a large part of the gallery.

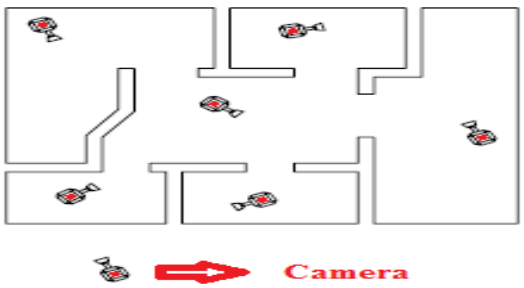

Fig. 1: Cameras are used for guarding an art gallery.

If we want to define the art gallery problem more precisely, we should first formalize the notion of gallery. A gallery is, of course, a 3-dimensional space, but a floor plan gives us enough information to place the cameras. Therefore we model a gallery as a polygonal region in the plane. We further restrict ourselves to regions that are simple polygons, that is, regions enclosed by a single closed polygonal chain that does not intersect itself. Thus we do not allow regions with holes. A camera position in the gallery corresponds to a point in the polygon. A camera sees those points in the polygon to which it can be

connected with an open segment that lies in the interior of the polygon.

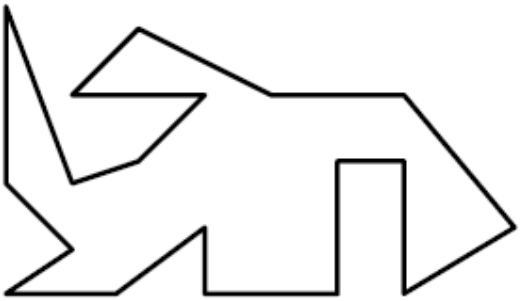

Fig . 2: A Simple Polygon.

Problem: World Wide Web Communities (w.w.w)

The w.w.w can be modeled as a graph, where the Web pages are denoted by vertices or dot and the hyperlinks between them are denoted by edges in the graph, the intersecting information by examining this Web Graph. As an example, the graph shown in below figure is termed a Web community. the vertices two different classes of objects, and each vertex representing one type of objects is connected to every vertex representing the other kind of objects is a Web community. In graph theory such a graph is called a complete bipartite graph.

On the left hand side of figure the five vertices are displayed with labels travel agency x.html, where 1≤X≤5. Each such label travelagencyX.html represents an HTML file for a given travel agency. On the right hand side of the fig. the three vertices have label www.alitalia.com, www.delta.com, and www.united.com. Each of these label is a web site of a well-known airline note that there is an edge between each HTML, file and each airline, but there are no edges between two HTMLS, file, nor are there and edges between two airlines. Such a graph structure is common on the web between competitors in the same industry. Rival companies do not have hyperlink on their web pages competitors. For example, Delta has no hyperlink to united Airlines. To be able to offer the best deal for their customers, travel agents often have hyperlinks from their web pages to all of the airlines as shown in figure. The travel agencies are also competing among themselves, so they too have no hyperlinks from one agency to any other.

Such web communities can be discovered by finding complete bipartite sub graphs in the web graph. Web community information is used for marketing purpose or for examining the relationship among companies in given industry.

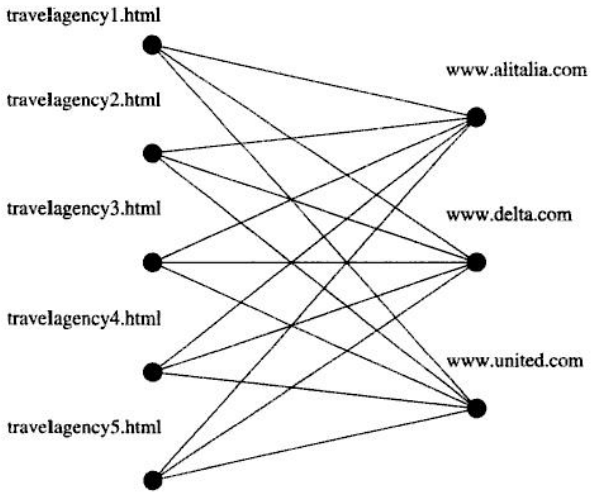

Figure 1.3: World Wide Web community.

CONCULSION

The aim of this paper is to present the theoretical ideas of graph in various field and mostly sciences like as computer sciences, chemical sciences, social networking they can use the graph theory. Also given that some basic definition and solving important problem related to this field.

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