APPLICATION OF GRAPH THEORY IN NETWORK ANALYSIS

Suresh Kumar[1] , R.B.S. Yadav[2]

1 *Research Scholar,Department of Mathematics,Magadh University,Bodh Gaya(Bihar)*

2 *Head(Professor), Department of Mathematics,Magadh University,Bodh Gaya(Bihar)*

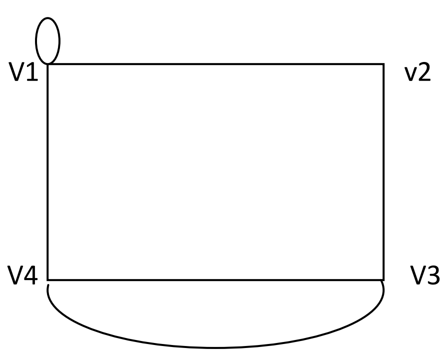
Abstract: Graph theory provides the basis for many network analysis techniques. Basic graph theory concepts are very general and can be applied to a wide variety of network problems such as topological design, routing reliability analysis, and network capacity. Specific examples demonstrate that graph theory is a practical tool for solving network and distributed system problems.

Keywords: Adjacency matrix, Incidence matrix, reliability.

INTRODUCTION

Any network problem can be represented by graph and graph can be represented by two different ways inside a computer,namely by using the adjacency matrix or the incidence matrix of a graph.

1 **Adjacency matrix:** If a graph G has n vertices,listed as $v_{1,}v_{2,}\dots,v_n$.The adjacency matrix of G,with respect to this particular listing of the n vertices of G,is the n×n matrix $A(G)=(A_{ij})$ where the (I,j)th entry v_i to the vertex v_j. The following figure 1 shows a graph G with vertices listed as $v_1,\dots,v_4$ and its adjacency matrix A(G) with respect to this listing. Figure 1:A graph and its adjacency matrix



A(G):4×4 matrix

	v1	v2	v3	v4
V1	1	1	0	1
V2	1	0	1	0
V3	0	1	0	2
V4	1	0	2	0

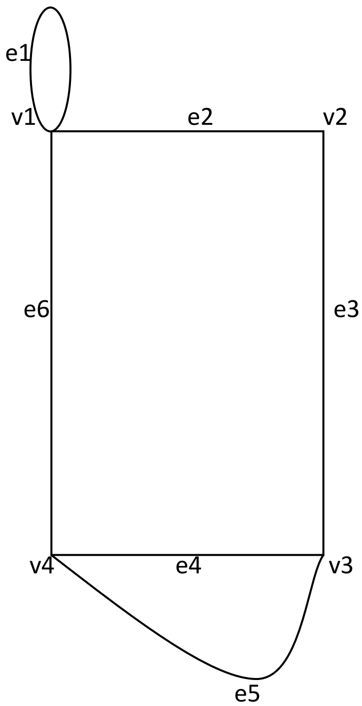
Here in A(G) we have $a_{ij=}a_{ji}$ for each I and j.Amatrix with this property is called symmetric.Also note that if G has no loops then all the entries of the main diagonal of A(G) are 0,while if G has no parallel edges then the entries of A(G) are either 0 or 1.

2 **Incidence matrix:** Suppose that G has n vertices,listed as $v_1,v_2,\dots,v_n$ and t edges,listed as $e_1,e_2,\dots,e_t$.The incidence matrix of G,with respect to these particular listings of the vertices and edges of G,is the n×t matrix $M(G)=(m_{ij})$ where the vertex v_i is incidence with the edge e_j i.e,

$$M_{ij} = \begin{cases} 0 \text{ if } v_i \text{ is not end of } e_j \\ 1 \text{ if } v_i \text{ is an end of the non-loop } e_j \\ 2 \text{ if } v_i \text{ is an end of the loop } e_j \end{cases}$$

The following figure 2 shows a graph G,with four vertices $v_1,\ldots,v_4$ and six edges $e_1,\ldots,e_6$ and its incidence matrix M(G) with respect to these listings of the vertices and edges.

Figure 2: A graph and its incidence matrix



M(G): A 4×6 matrix

	e1	e2	e3	e4	e5	e6
v1	2	1	0	0	0	1
v2	0	1	1	0	0	0
v3	0	0	1	1	1	0
v4	0	0	0	1	1	1

REFERENCES

[1] K.Suresh and Yadav R.B.S "Projective Transformation in Computer Vision ",Proceedings of International Conference on Recent trends in Computing ICRTC-2012,pp.145-147.

[2] K.Suresh and Yadav R.B.S "Relational Algebra in SQL", International Journal of Mathematics Trends and Technology volume 4 issue 2/March-April 2013,pp 35-37.

[3] Deo Narsingh,"Graph Theory with Applications to Engineering and Computer Science", PHI Learning Private Limited,2009.

[4] Agnarsson Geir & Greenlaw Raymond "Graph Theory Modeling Applications, and Algorithms", Pearson Education, 2008.