MANIPAL UNIVERSITY JAIPUR
(University under Section 2(f) of the UGC Act)

B.TECH. SECOND YEAR

(III SEM. CSE/IT/CCE)

ACADEMIC YEAR: 2020-2021

COURSE NAME: ENGINEERING MATHEMATICS III

COURSE CODE : MA 2101

LECTURE SERIES NO : UNIT-III (LECTURE NO. 14- 22)

CREDITS : 3

MODE OF DELIVERY : ONLINE (POWER POINT PRESENTATION)

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PROPOSED DATE OF DELIVERY: August 17, 2020

MANIPAL UNIVERSITY JAIPUR

VISION

Global Leadership in Higher Education and Human Development

MISSION

- Be the most preferred University for innovative and interdisciplinary learning
- Foster academic, research and professional excellence in all domains
- Transform young minds into competent professionals with good human values

VALUES

Integrity, Transparency, Quality,
Team Work, Execution with Passion, Humane Touch

SESSION OUTCOME

"TO UNDERSTAND THE CONCEPT OF TREES AND APPLY THE TREE ALGORITHMS TO ANALYZE THE SHORTEST PATH PROBLEMS"

ASSESSMENT CRITERIA

ASSIGNMENT

QUIZ

MID TERM EXAMINATION –I & II

END TERM EXAMINATION

PROGRAM OUTCOMES MAPPING WITH CO3

[PO1]

ENGINEERING KNOWLEDGE: APPLY THE KNOWLEDGE OF MATHEMATICS, SCIENCE, ENGINEERING FUNDAMENTALS, AND AN ENGINEERING SPECIALIZATION TO THE SOLUTION OF COMPLEX ENGINEERING PROBLEMS.

Matrix Representation of a Graph

A pictorial representation of a graph is very convenient for a visual study. A matrix is a convenient and useful way of representing a graph to a computer. In many applications of graph theory, such as in electrical network analysis and operations research, matrices also turn out to e the natural way of expressing the problem.

- Adjacency matrix
- Incidence matrix
- Undirected graphs and symmetric matrices
- Number of walks of a particular length between two vertices

Representing Graphs

Definition: Let $G = (V, E)$ be a simple graph with $|V| = n$ (no two edges connect the same pair of vertices and each edge connects two different vertices). Suppose that the vertices of G are listed in arbitrary order as $v_1, v_2, \ldots, v_n$.

The **adjacency matrix** A (or A_G) of G, with respect to this listing of the vertices, is the $n \times n$ zero-one matrix with 1 as its (i, j) entry when v_i and v_j are adjacent, and 0 otherwise.

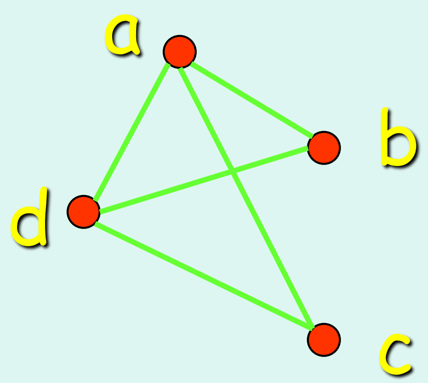
In other words, for an adjacency matrix $A = [a_{ij}]$,

$a_{ij} = 1$ if $\{v_i, v_j\}$ is an edge of G,

$a_{ij} = 0$ otherwise.

Representing Undirected Graphs

Example: What is the adjacency matrix A_G for the following graph G based on the order of vertices a, b, c, d ?



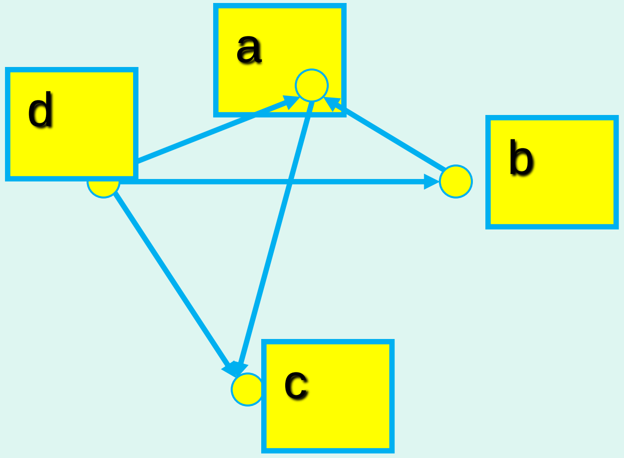
Solution:

$$A_G = \begin{bmatrix} 0 & 1 & 1 & 1 \\ 1 & 0 & 0 & 1 \\ 1 & 0 & 0 & 1 \\ 1 & 1 & 1 & 0 \end{bmatrix}$$

Note: Adjacency matrices of undirected graphs are always symmetric.

Representing Directed Graphs

Example: What is the adjacency matrix A_G for the following directed graph G based on the order of vertices a, b, c, d ?

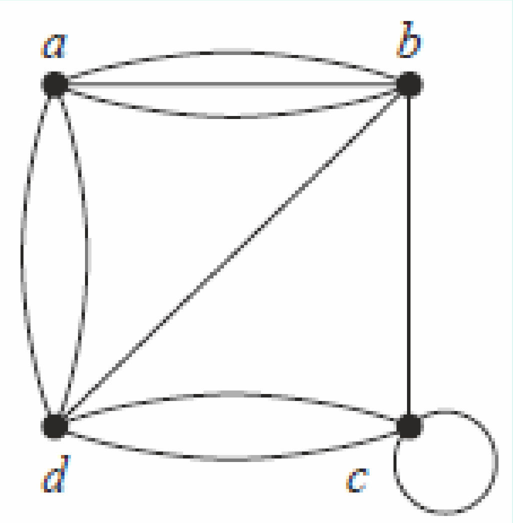


Solution:

$$A_G = \begin{bmatrix} 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 1 & 1 & 1 & 0 \end{bmatrix}$$

Representing Pseudo Graphs

Example : What is the adjacency matrix A_G for the following pseudo graph G based on the order of vertices a, b, c, d ?



Solution:

$$\begin{bmatrix} 0 & 3 & 0 & 2 \\ 3 & 0 & 1 & 1 \\ 0 & 1 & 1 & 2 \\ 2 & 1 & 2 & 0 \end{bmatrix}$$

Representing Graphs

Definition: Let $G = (V, E)$ be an undirected graph with $|V| = n$. Suppose that the vertices and edges of G are listed in arbitrary order as $v_1, v_2, \ldots, v_n$ and $e_1, e_2, \ldots, e_m$, respectively.

The **Incidence matrix** of G with respect to this listing of the vertices and edges is the $n \times m$ zero-one matrix with 1 as its (i, j) entry when edge e_j is incident with v_i, and 0 otherwise.

In other words, for an incidence matrix $M = [m_{ij}]$,

$m_{ij} = 1$ if edge e_j is incident with v_i

$m_{ij} = 0$ otherwise.