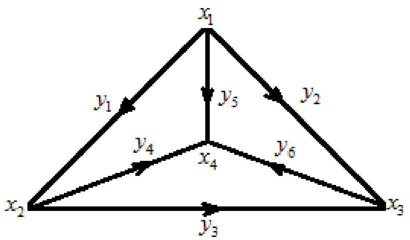
Step-1

We follow the basic difference between an incident matrix and an adjacency matrix.

In an incidence matrix, the row heads are edges and column heads are nodes where as in an adjacency matrix, both the row as well as the column heads are nodes such that if there is an edge from i^{th} node to j^{th} node, then the entry in the ij^{th} place is 1 and otherwise zero.



Step-2

The adjacency matrix of this graph is

$$M = \begin{array}{c} \\ x_1 \\ x_2 \\ x_3 \\ x_4 \end{array} \begin{array}{c} \begin{array}{cccc} x_1 & x_2 & x_3 & x_4 \end{array} \\ \begin{bmatrix} 0 & 1 & 1 & 1 \\ 1 & 0 & 1 & 1 \\ 1 & 1 & 0 & 1 \\ 1 & 1 & 1 & 0 \end{bmatrix} \end{array}$$

Note that we disregarded the direction of the arrow and considered just the edge between the respective nodes.

Step-3

The square of the adjacency matrix is nothing but the product of the adjacency matrix with itself.

If there is an edge between the nodes x_i, x_j and there is an edge between x_j, x_k, then we get the number of paths between x_i, x_k through different nodes in M^2.

$$M^2 = \begin{bmatrix} 0 & 1 & 1 & 1 \\ 1 & 0 & 1 & 1 \\ 1 & 1 & 0 & 1 \\ 1 & 1 & 1 & 0 \end{bmatrix} \begin{bmatrix} 0 & 1 & 1 & 1 \\ 1 & 0 & 1 & 1 \\ 1 & 1 & 0 & 1 \\ 1 & 1 & 1 & 0 \end{bmatrix}$$

$$= \begin{bmatrix} 3 & 2 & 2 & 2 \\ 2 & 3 & 2 & 2 \\ 2 & 2 & 3 & 2 \\ 2 & 2 & 2 & 3 \end{bmatrix}$$

$$\left(M^2\right)_{ij} = x_{i1}x_{1j} + \ldots\ldots\ldots\ldots + x_{in}x_{nj}$$

We follow that $x_{ik}x_{kj} = 1$ if there is an edge between x_i, x_k and an edge between x_k, x_j

If there is a missing of either of these edges, then the entry $x_{ik}x_{kj}$ will be zero.