

Incidence Matrices - Software Testing

Graphs need not be represented pictorially – they can be fully represented in an incidence matrix. This concept becomes very useful for testers. So we will formalize it here. When graphs are given a specific interpretation, the incidence matrix always provides useful information for the new interpretation.

Definition:

The incidence matrix of a graph $G = (V, E)$ with m nodes and n edges is an $m \times n$ matrix, where the element in row i , column j is a 1 if and only if node i is an endpoint of edge j ; otherwise, the element is 0. the incidence matrix of the graph in figure is:

	e_1	e_2	e_3	e_4	e_5
n_1	1	1	0	0	0
n_2	1	0	0	1	0
n_3	0	0	1	0	0
n_4	0	1	1	0	1
n_5	0	0	0	1	0
n_6	0	0	0	0	1
n_7	0	0	0	0	0

We can make some observations about a graph by examining its incidence matrix. First notice that the sum of the entries in any column is 2. That is because edge has exactly two endpoints. If a column sum in an incidence matrix is over something other than 2, there is a mistake somewhere. Thus forming column sums is a form of integrity checking similar in spirit to that of parity checks. Next we see that the row sum is the degree of the node. When the degree of a node is zero, as it is for node n_7 , we say the node is isolated. (This might correspond to unreachable code or to objects that are included but never used.)