Abstract

Graphs with labels from different algebraic structures are considered. Since corresponding to every graph there is a square matrix with the labels as elements, the study of matrices gives properties of labeled graphs. The algebraic structures considered here are real numbers, nonnegative numbers, natural numbers, boolean literals, and regular expressions. While studying real matrices we use the intrinsic polynomial \(|I - sA|\) instead of the characteristic polynomial \(|\lambda I - A|\). Intrinsic values are the nonzero eigenvalues of \(A\) and they play an important role in the study of graphs. In the study of nonnegative matrices the concept of a cyclant happens to be quite useful. Natural matrices arise when parallel edges are allowed in a graph. The path matrix \((I - sA)^{-1}\) gives all the paths in such a graph. The permanent gives the matchings in the corresponding bigraph. Boolean matrices arise when parallel edges are not allowed in a graph. Thus the properties of simple graphs can be studied in terms of the boolean matrices. It is interesting to note that the concept of an eigenvector remains even when we consider matrices with regular expressions as elements. In this thesis, by a graph is meant a digraph and undirected graphs are considered as special cases of digraphs.