Abstract

In this thesis, we have introduced a new simplicial complex $\Delta_{n \times n}(\mathfrak{R})$ on $n \times n$ chessboard. This complex is obtained through the possible movement of n rooks placed anywhere on the board, that is why the name Rook Complex is given. We have studied many algebraic and combinatorial properties of these complexes. We have determined the facet ideal of $\Delta_{n \times m}(\mathfrak{R})$ and hence found the type of minimal vertex covers of this ideal of cardinality n, $n+1$ and $n+2$. We have also determined its Stanley-Resiner ideal and have found its minimal primary decomposition. Also, we have given the formula for the f-vector of $\Delta_{n \times m}(\mathfrak{R})$ and hence given the Hilbert function and Hilbert series of Stanley-Resiner ring $K[\Delta_{n \times m}(\mathfrak{R})]$. We have also discussed shellability, connectedness and Cohen-Macaulayness of these complexes.