Revised simplex algorithm is a proven, well founded and established procedure to solve linear programming problems. It is essentially a univariate search technique and exhibits slow converging properties. Multivariate search techniques such as the gradient method possess the property of rapid convergence. The choice of multiple variables which is proposed in this thesis to form a basis enables to make a search in the direction of the steepest ascent/descent of the objective function. A matrix of intercepts (referred to as 'S' matrix) of the promising variables is constructed to select more than one variable to enter the basis at a time. This matrix enables to select a set of linearly independent vectors to enter the basis. The multiplex algorithm proposed in this thesis not only brings into the basis a cluster of variables at the commencement of computations but also in between passes until optimal solution is obtained. This algorithm reduces the number of iterations and computations considerably.
The multiplex algorithm arrests variables popping in and out of bases. In other words, it attempts to bring into the basis only such variables which once enter do not leave until optimal solution is obtained. This property has significantly contributed to the computational efficiency. The number of iterations and computational effort required for the multiplex algorithm are less compared to the revised simplex algorithm. The multiplex algorithm possesses the virtue of avoiding the intriguing problem of cycling while seeking solution for the linear programming problems. The 'Θ' matrix which is the basis for the development of the multiplex algorithm has the potential to detect redundant constraints which could be removed before the commencement of computation. Such identification and removal of redundant constraints may lead to further saving in computational effort. Multiplex algorithm is more effective in handling linear programming problems which have constraint matrix of high sparsity. The bounded variables problem can also be solved using the multiplex algorithm with a minor modification in the 'Θ' matrix. Infeasibility, if any, created can be removed using the dual simplex algorithm or the dual multiplex algorithm.
Four packages in Fortran, one for the revised simplex and another for the multiplex algorithm, a third for the simplex bounded algorithm and the last for the multiplex bounded algorithm have been developed. A number of linear programming problems was run on IBM System 370/Model 155-II and the results are compared. Multiplex algorithm invariably solves all textbook examples in one pass.

The multiplex algorithm could be easily extended to solve problems amenable to solution by the decomposition principle and quadratic programming principle. Since the multiplex algorithm seems to possess a vast scope for improvement it will be challenging to exploit it further to solve any linear programming problem in \( m \) number of iterations/basis changes itself.