The present thesis entitled "MATHEMATICAL PROGRAMMING APPLICATIONS IN SAMPLING" is submitted to Aligarh Muslim University, Aligarh to supplicate the degree of Doctor of Philosophy in Statistics. It embodies the research work carried out by me in the Department of Statistics and Operations Research, Aligarh Muslim University during 1991-1994.

In the development of theory underlying statistical methods, one is frequently faced with optimization problems. Attempts have therefore been made to find optimization techniques that have wider applicability and can be easily implemented with the available computing power. Mathematical programming is one such technique that has the potential for increasing the scope for application of statistical methodology. Some optimization problems from the area of sampling are considered in this thesis and mathematical programming techniques like dynamic programming, separable programming etc. are applied to obtain a solution.

This thesis consists of four chapters. Chapter I gives an account of the gradual development in mathematical programming techniques. Mathematical programming models are widely used to solve a variety of military, economic,
industrial, social, engineering etc. problems. Applications of mathematical programming in various fields are also presented in brief.

In CHAPTER II, the problem of determining the optimum number of strata in various situations is considered. The cases, when the main variable y itself and when an auxiliary variable x is used as stratification variable are discussed. The problem is formulated as a mathematical programming problem and a solution is obtained by using Kuhn-Tucker (K-T) conditions. The contents of this chapter constitute my joint paper entitled "Optimum Number of Strata for surveys with small sample size" is to appear in the Aligarh Journal of Statistics, Aligarh, India in its 1995 issue.

The problem of optimum allocation of sample sizes in stratified sample survey is considered in chapter III. The objective is to find sample sizes that minimizes the total cost of the survey for a desired precision of the estimated population mean. Apart from the measurement cost, the total cost of the survey also includes the travelling cost within strata. The problem is formulated as a mathematical programming problem and a solution procedure is indicated by using Simplex method by approximating the nonlinear functions to linear functions. The possible extension of this technique to the multivariate case is also presented. This work is based on my joint research paper entitled

In multivariate surveys where more than one character are under study the optimum allocation becomes complicated due to the fact that what is optimum for one character is generally not optimum for others. Thus a suitable overall optimality criterion is to be worked out. In chapter IV we consider the situation when the cost of measurement varies with stratum as well as with various characters under study. The resulting problem is formulated as a nonlinear programming problem and dynamic programming technique is applied to obtain a solution. A graphical representation of the problem is also presented by a numerical problem. This chapter is based on my joint research paper entitled "A Generalized Optimum Allocation" presented in the Fourth Islamic Countries Conference on Statistical Sciences held at Lahore (Pakistan) in August 1994. This paper is also appearing in the Journal of Indian Statistical Association, Pune, India, in its December 1994 issue.

A comprehensive list of references is presented at the end of the thesis.