Abstract

The present thesis entitled “Integer Optimization in Sample Surveys” is an outcome of the studies made by the author at the Department of Statistics and Operations Research, Aligarh Muslim University, Aligarh, India.

There are two generally accepted options for studying the characteristics of a finite population. The first is to study each and every unit of the population. This is called census or complete enumeration. The other is through the study of only a selected portion of the population. This selected portion is called a sample and this method is called sampling or sample survey. Census is time consuming, expensive, even impossible in some situations and often in accurate. On the other hand a sample survey costs less in terms of time and money both and usually is more accurate then census. A good survey free from errors and biases can render a very useful service in the solution of many socio-economic problems of a country by accelerating the timely flow of adequate and reliable information.

Mathematical programming is concerned with the determination of the minimum or maximum of a function of several variables, which are subject to a number of constraints. Such situations exist in diverse fields of human activities e. g. Engineering Sciences, Operations Research, Management Sciences, Computer Sciences, Numerical analysis, System analysis, Economics, Military Sciences, Transportations, Assignments, Medical Sciences, Agriculture, Statistical analysis etc.

This thesis is an attempt to formulate some problems arising in univariate and multivariate stratified sample surveys as mathematical programming problems and various techniques are developed for their solution. The thesis consists of seven chapters. Articles, definitions and equations have been numbered chapter wise in such
Abstract

a way that, when read as decimals they stand in their proper order e.g., (6.5.1) refers to equation number 1 of section 5 of chapter 6.

Chapter-I provides an introduction to the historical background of survey sampling, Non-Response in sample surveys, Optimization problem arise in Stratified Sampling, Mathematical programming techniques & their applications to various fields including sampling.

Chapter II: This chapter is based on my research paper “Optimum sample sizes in case of stratified sampling for non-respondents: an integer solution” published in *International Journal of Operations Research and Optimization*. Here the problem is to determine the sample sizes for the fixed total sample size to various strata in presence of non-response and then to find the optimum sub sample sizes among the non-respondents in stratified sampling. The integer solution is found by using branch and bound method. A computer program in C++ language is also written for calculating sample sizes and sub-sample sizes.

Chapter III: This chapter is based on my research paper “A new cutting plane method for finding the integer solution of allocation problem in Stratified Sampling” published in *International Journal of Operations Research and Optimization*. Here we have developed a cut using the concept of greatest integer that reduces the feasible region of the original problem. We then search the integer point inside this feasible region. A numerical example is presented to illustrate the computational procedure. A computer program in C++ language for calculating sample sizes and value of the objective function are also included in this chapter.

Chapter IV: This chapter is based on my research paper “A new cut applied to the formulated allocation problem of Stratified Sampling using Confidence interval where pre specified levels of precision are desired” published in *International Journal of Computer Engineering*. In this chapter, we have used a New Cut for reducing the feasible region of the stratified sampling problem formulated as a Non Linear Integer
Programming problem (NLIPP) using confidence interval and solved the reduced problem for the integer solution by Lingo Software.

Chapter V: This chapter is based on my research paper “Goal Programming and Lexicographic goal programming approaches in bi-objective stratified sampling: An Integer Solution” accepted in *International Journal of Scientific Computing*. In this chapter goal programming (GP) and Lexicographic goal programming (PGP) approaches are used for allocating the sample sizes in stratified random sampling problem. We have discussed the methods how to solve the allocation problems in stratified sampling & compared both the methods.

Chapter VI: This chapter is based on my research paper “Allocation of Sample Size in bi-objective Stratified Sampling using Lexicographic Goal Programming” communicated in *International Journal of Engineering, Science and Technology*. In this chapter we have discussed allocation of sample size in stratified sampling using $D_1$-distances. The solution corresponding to the minimum distance is the best compromise solution. A numerical example is presented to illustrate the computational procedure.

Chapter VII: This chapter is based on my research paper “Allocation in Multivariate Stratified Sampling in Presence of Non-Response: A New Approach” communicated in *Communications in Statistics - Simulation and Computation*. In this chapter the proposed Lagrange Multiplier’s Technique (LMT) provide a minimum coefficients of variance among the non-respondent as compared to the Goal programming technique. The numerical example is presented to illustrate the computational details.

A comprehensive list of references, arranged in alphabetical order is also provided at the end of the thesis. Some of the references used in the thesis are given below.
REFERENCES


