

## **An Optimization Approach Applied the Multivariate Optimal Allocation in Stratified Sample Designs**

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The problem of optimal allocation of samples in surveys using a stratified sampling plan was first discussed by Neyman in 1934. In his study he presented an entire framework for the univariate optimum allocation problem. Since then, many researchers have studied the problem of the sample allocation in multivariate surveys and several methods have been proposed. Basically, these methods are divided into two class: The first involves forming a weighed average of the stratum variances and finding the optimal allocation for the average variance. The second class is associated with methods that require that each variance (associated with each survey variable) satisfy an inequality constraint. Or, equivalently, an acceptable coefficient of variation for each of the variables on which the allocation is to be done. Particularly, this paper proposes two new optimization approaches to the second problem. The first approach is based on an integer programming formulation and the second approach is associated with the application of the two algorithms that used the concepts of GRASP (Greedy Randomized Adaptive Search Procedure) and VNS (Variable Neighborhood Search) metaheuristics. Several experiments and analyses were done with a variety of real data and the computational results showed that the proposed approaches are efficient ways to solve this problem, considering a comparison of these approaches with the other approaches from the literature.

Key Words: Optimal Allocation, optimization, integer programming, metaheuristics