Solving Optimum Allocation Problems in Stratified Sampling Using the R Package stratallo

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July 7, 2026

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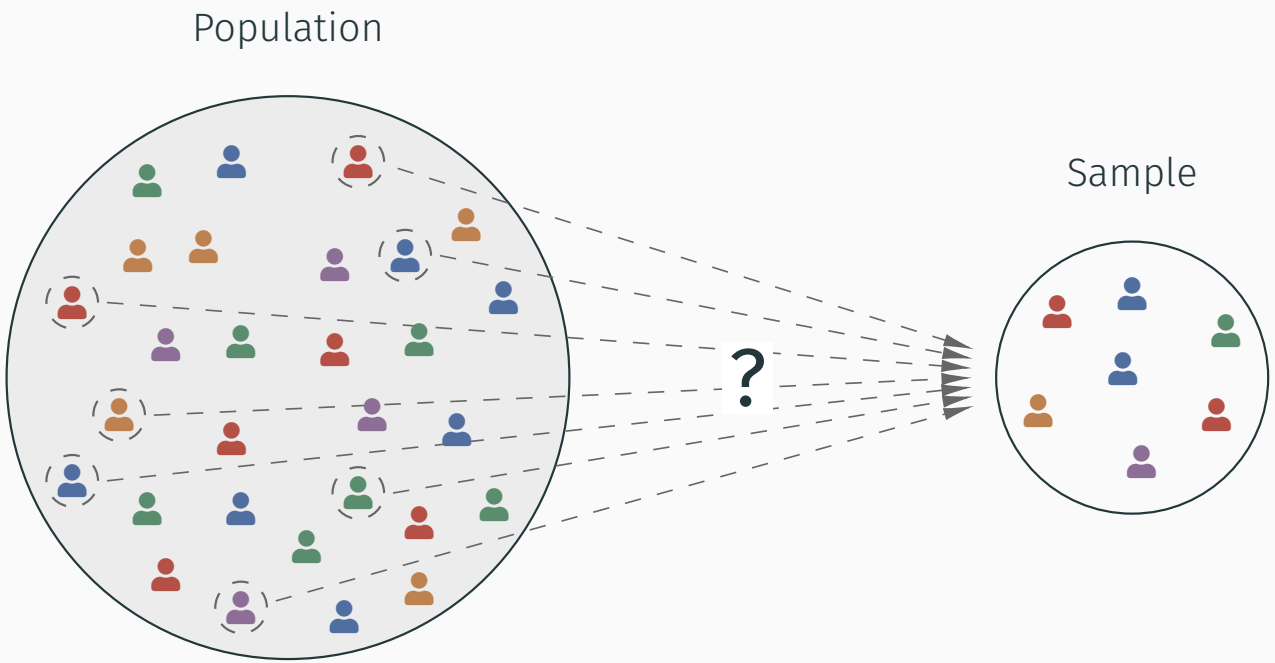
Background: Survey Sampling

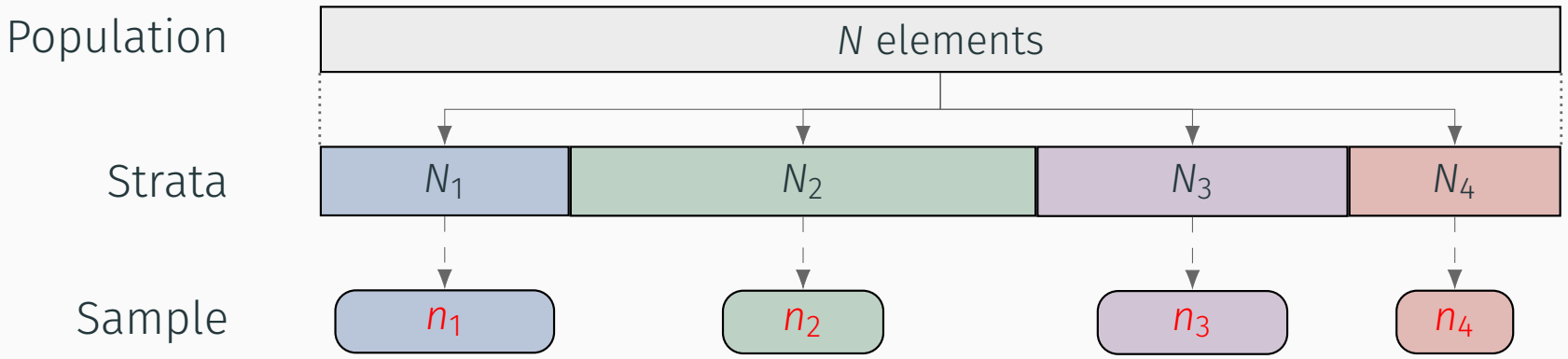
Survey Sampling:

- Branch of statistics.
- Concerned with drawing inferences about finite populations from random samples.



Optimum Allocation in Stratified Sampling

A population is **partitioned** into strata (e.g., individuals by age).



Optimum allocation problem:

$$(n_1, n_2, n_3, n_4) = ?$$

Determined by:

- maximizing precision (minimize variance) of the estimators,
- subject to a fixed survey budget.

Example Optimum Allocation Problem

H	total number of strata
$S_h^2, \quad h = 1, \ldots, H$	strata variances (of the study var.)
$N_h, \quad h = 1, \ldots, H$	strata sizes
$0 < m_h < M_h \leq N_h, \quad h = 1, \ldots, H$	bounds for sample sizes in strata
$n \in \left[\sum_{h=1}^{H} m_h,\ \sum_{h=1}^{H} M_h\right]$	total sample size

$$\underset{(n_1, \ldots, n_H) \in \mathbb{R}^H}{\text{minimize}} \quad \sum_{h=1}^{H} \frac{N_h^2 S_h^2}{n_h} \tag{1a}$$

$$\text{subject to} \quad \sum_{h=1}^{H} n_h = n, \tag{1b}$$

$$m_h \leq n_h \leq M_h, \qquad h = 1, \ldots, H. \tag{1c}$$

stratallo

- Implements **exact algorithms** for **optimal sample allocation**.
- Includes both **classical** and **new** algorithms.
- Available on CRAN since May 2020. Latest version: 3.0.1 (2026-03-12).
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(cumulative, as of 2026-07-07)

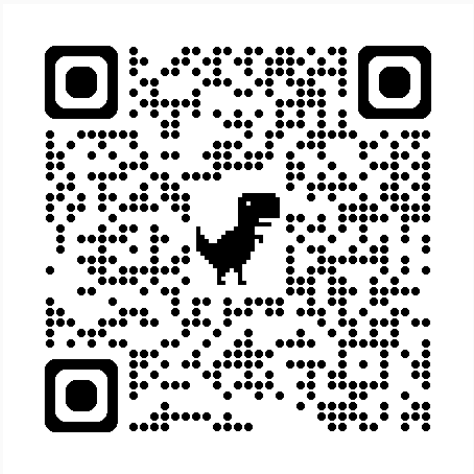
Optimal Allocation with stratallo


```r
library(stratallo)

# Parameters.
N <- c(3000, 4000, 5000, 2000)
S <- c(94, 179, 276, 4)
m <- c(100, 90, 500, 40)
n <- 10000

n >= sum(m) && n <= sum(N)
# > [1] TRUE

# Optimum allocation.
nopt <- opt(n = n, A = N * S, m = m, M = N)
nopt
# > [1] 1401.523 3558.477 5000.000 40.000

# Optimal rounding.
round_oric(nopt)
# > [1] 1402 3558 5000 40
```

Implementation of stratallo

- All computations are implemented purely in R using only simple **atomic vectors**.
- External **package dependencies** are kept to a **minimum**.
- Follows standard R package practices:
  - documentation,
  - unit testing,
  - assertions,
  - version control,
  - CI/CD,
  - publicly available on GitHub.

stratallo



https://wwojciech.github.io/stratallo/