**INPUT:**

# Sample data

X <- c(76, 67, 29, 23, 37, 61, 93, 78, 67, 60, 46, 25, 50, 44, 77, 64, 64, 40, 40, 50)

Y <- c(80, 67, 30, 40, 63, 69, 104, 106, 86, 57, 65, 50, 64, 58, 89, 63, 77, 60, 64, 62)

# Population size

N <- 196

# Sample size

n <- length(X)

# True total population (2001)

true\_total <- 22919

# Simple Random Sampling (SRS) estimation

srs\_estimate <- (N / n) \* sum(X)

srs\_variance <- (N^2 \* (N - n) / (n \* (N - 1))) \* var(X)

# Ratio Estimation

ratio <- sum(Y) / sum(X)

ratio\_estimate <- (N / n) \* sum(X) \* ratio

ratio\_variance <- (N^2 \* (N - n) / (n \* (N - 1))) \* var(X \* ratio)

# Print results

cat("Simple Random Sampling Estimation:\n")

cat("Estimated Total:", srs\_estimate, "\n")

cat("Variance:", srs\_variance, "\n")

cat("Standard Error:", sqrt(srs\_variance), "\n")

cat("\nRatio Estimation:\n")

cat("Estimated Total:", ratio\_estimate, "\n")

cat("Variance:", ratio\_variance, "\n")

cat("Standard Error:", sqrt(ratio\_variance), "\n")

**OUTPUT:**

**Simple Random Sampling Estimation:**

Estimated Total: 10691.8

Variance: 641535.4

Standard Error: 800.959

**Ratio Estimation:**

Estimated Total: 13269.2

Variance: 988117.2

Standard Error: 994.0408