ForexamSample Spearman Rank-Order Correlation (Small\_Data\_Samples \_without \_Ties)

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## Introduction

This analysis applies the **Spearman Rank-Order Correlation** to examine the relationship between **Number of Visits** and **Mean Heart Rate** for a small dataset without ties.

## Step 1: State the Hypotheses

* **Null Hypothesis (H₀):** There is no significant correlation between the number of visits and the mean heart rate.
* **Alternative Hypothesis (H₁):** There is a significant correlation between the number of visits and the mean heart rate. ## Step 2: Set the Level of Significance We set **α = 0.05** as the significance level. ## Step 3: Load and Prepare Data

data <- tibble(  
 Participant = 1:8,  
 Visits = c(5, 12, 7, 14, 2, 8, 15, 17),  
 HeartRate = c(100, 89, 78, 66, 77, 103, 67, 63)  
)  
print(data)

## # A tibble: 8 × 3  
## Participant Visits HeartRate  
## <int> <dbl> <dbl>  
## 1 1 5 100  
## 2 2 12 89  
## 3 3 7 78  
## 4 4 14 66  
## 5 5 2 77  
## 6 6 8 103  
## 7 7 15 67  
## 8 8 17 63

## Rank the data

You can also embed plots, for example:

## # A tibble: 8 × 9  
## Participant Visits HeartRate Rank\_Visits Rank\_HeartRate D D\_squared  
## <int> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl>  
## 1 1 5 100 2 7 -5 25  
## 2 2 12 89 5 6 -1 1  
## 3 3 7 78 3 5 -2 4  
## 4 4 14 66 6 2 4 16  
## 5 5 2 77 1 4 -3 9  
## 6 6 8 103 4 8 -4 16  
## 7 7 15 67 7 3 4 16  
## 8 8 17 63 8 1 7 49  
## # ℹ 2 more variables: Ties\_Visits <lgl>, Ties\_HeartRate <lgl>

## Step 4: Compute Spearman’s Rank Correlation Coefficient

The formula for Spearman’s Rank Correlation Coefficient is:

where: - is the difference between ranks, - is the number of observations.

n <- nrow(ranked\_data)  
D\_squared\_sum <- sum(ranked\_data$D\_squared)  
  
r\_s <- 1 - (6 \* D\_squared\_sum) / (n \* (n^2 - 1))  
  
cat("Spearman Rank Correlation Coefficient (ρ):", round(r\_s, 4), "\n")

## Spearman Rank Correlation Coefficient (ρ): -0.619

## Step 5: Determine the Critical Value

For **n = 8** and **α = 0.05 (two-tailed test)**, the critical value from the **Spearman correlation table** is **±0.738**.

## Step 6: Compare the Obtained Value with the Critical Value

if (abs(r\_s) >= 0.738) {  
 cat("The correlation is statistically significant. We reject H₀ and conclude there is a significant correlation.\n")  
} else {  
 cat("The correlation is not statistically significant. We fail to reject H₀.\n")  
}

## The correlation is not statistically significant. We fail to reject H₀.

## Step 7: Interpret the Results

If **|ρ| ≥ 0.738**, the result is significant.

## Step 8: Reporting the Results

*A Spearman rank-order correlation was conducted to determine the relationship between the number of visits and mean heart rate. The analysis yielded ρ = -0.619. Since the obtained ρ is less than the critical value of 0.738, we fail to reject the null hypothesis. This suggests that there is no significant correlation between the two variables.*