WAP of 2 WAY ANOVA in R

**Problem Example:**

We want to study the effect of **exercise type** and **diet type** on **weight loss** in individuals. We conduct a study where we assign participants to two different exercise types (Exercise A and Exercise B) and two different diet plans (Diet X and Diet Y). After 4 weeks, we measure their weight loss (in kilograms).

**Research Question:**

Does the **exercise type** or **diet type** (or their interaction) significantly affect weight loss?

**Factors:**

1. **Exercise Type (Factor 1)**:
   * Exercise A
   * Exercise B
2. **Diet Type (Factor 2)**:
   * Diet X
   * Diet Y

**Dependent Variable:**

* **Weight Loss (Outcome)**: The weight loss in kilograms after 4 weeks.

**Data Example (Excel Layout):**

| **Exercise Type** | **Diet Type** | **Weight Loss (kg)** |
| --- | --- | --- |
| A | X | 3.5 |
| A | X | 4.2 |
| A | Y | 2.8 |
| A | Y | 3.1 |
| B | X | 5.3 |
| B | X | 4.9 |
| B | Y | 3.7 |
| B | Y | 3.9 |

**Steps for Performing Two-Way ANOVA in R:**

1. **Load the data** into R (either from Excel or create it manually in R).
2. **Run the Two-Way ANOVA** to test the effect of both Exercise and Diet on weight loss, and check if there’s an interaction between these two factors.

**Sample R Code for Two-Way ANOVA (without loading a file):**

# Load necessary libraries

install.packages("readxl")

library(readxl)

# Example data (you can load your Excel file here instead)

data <- data.frame(ExerciseType = factor(c('A', 'A', 'A', 'A', 'B', 'B', 'B', 'B')), DietType = factor(c('X', 'X', 'Y', 'Y', 'X', 'X', 'Y', 'Y')), WeightLoss = c(3.5, 4.2, 2.8, 3.1, 5.3, 4.9, 3.7, 3.9))

# Perform Two-Way ANOVA

anova\_result <- aov(WeightLoss ~ ExerciseType \* DietType, data = data)

# Show ANOVA result

summary(anova\_result)

**2 WAY ANOVA (with file load)**

**1. Install and Load Necessary Libraries**

First, you need to install and load the readxl package to read your Excel file and the openxlsx package to handle the data.

**# Install the required packages**

**install.packages("readxl")**

**install.packages("openxlsx")**

**# Load the libraries**

**library(readxl)**

**library(openxlsx)**

**2. Load the Data from Your Excel File**

Assuming your Excel file has two categorical columns (e.g., Factor1 and Factor2) and one numeric column (e.g., Outcome).

**# Load the data from your Excel file**

**data <- read\_excel("C:/Users/HP/Desktop/anova.xlsx")**

**# Check if the data is loaded correctly**

**head(data)**

Your Excel file should have columns that match the structure needed for Two-Way ANOVA:

* Factor1: e.g., A, B (categorical variable).
* Factor2: e.g., X, Y (categorical variable).
* Outcome: A numeric column representing the dependent variable.

**3. Ensure Columns Are Properly Coded**

R will need the factors (categorical variables) to be in factor format and the outcome (numeric) to be in numeric format. Convert them if needed:

**# Convert the columns to the correct format**

**data$Factor1 <- as.factor(data$Factor1)**

**data$Factor2 <- as.factor(data$Factor2)**

**data$Outcome <- as.numeric(data$Outcome)**

**4. Perform Two-Way ANOVA**

Now you can run the Two-Way ANOVA:

**# Perform Two-Way ANOVA**

**anova\_result <- aov(Outcome ~ Factor1 \* Factor2, data = data)**

**# Display the ANOVA table**

**summary(anova\_result)**

**5. Interpret the Output**

* Factor1: Tests the main effect of the first factor (e.g., Exercise Type).
* Factor2: Tests the main effect of the second factor (e.g., Diet Type).
* Factor1: Tests the interaction effect between the two factors.

**Example of the Output:**

**Df Sum Sq Mean Sq F value Pr(>F)**

**Factor1 1 15.0 15.0 3.75 0.07 # Effect of Exercise Type (not significant if p > 0.05)**

**Factor2 1 25.0 25.0 5.25 0.02 \* # Effect of Diet Type (significant if p < 0.05)**

**Factor1:Factor2 1 8.0 8.0 2.12 0.15 # Interaction Effect**

**(not significant)**

**Residuals 40 95.0 2.38**