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tension_bond_data <- data.frame(
  Modified_Mortar = c(16.85, 16.40, 17.21, 16.35, 16.52, 17.04, 16.96,
17.15, 16.59, 16.57),
  Unmodified_Mortar = c(16.62, 16.75, 17.37, 17.12, 16.98, 16.87, 17.34,
17.02, 17.08, 17.27)
)

# Viewing the data frame
print(tension_bond_data)
attach(tension_bond_data)
# Calculating the average for Modified and Unmodified Mortar
modified_avg <- mean(tension_bond_data$Modified_Mortar)
unmodified_avg <- mean(tension_bond_data$Unmodified_Mortar)

# Calculating the variance for Modified and Unmodified Mortar
modified_var <- var(tension_bond_data$Modified_Mortar)
unmodified_var <- var(tension_bond_data$Unmodified_Mortar)

# Display the results
cat("Average for Modified Mortar:", modified_avg, "\n")
cat("Average for Unmodified Mortar:", unmodified_avg, "\n")
cat("Variance for Modified Mortar:", modified_var, "\n")
cat("Variance for Unmodified Mortar:", unmodified_var, "\n")

# Creating a boxplot for the two sets of data
boxplot(tension_bond_data$Modified_Mortar,
tension_bond_data$Unmodified_Mortar,
  names = c("Modified Mortar", "Unmodified Mortar"),
  main = "Boxplot of Tension Bond Strength",
  ylab = "Tension Bond Strength",
  col = c("lightblue", "lightgreen"))

# Perform a two-sample t-test
t_test_result <- t.test(tension_bond_data$Modified_Mortar,
tension_bond_data$Unmodified_Mortar)

# Display the results
print(t_test_result)

# Perform a two-sample t-test with equal variance
t_test_result_equal_var <- t.test(tension_bond_data$Modified_Mortar,
tension_bond_data$Unmodified_Mortar,
var.equal = TRUE)

# Display the results

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print(t_test_result_equal_var)

# Combine data into long format for easier plotting and analysis
long_data <- stack(tension_bond_data)

# 1. Check normality using the Shapiro-Wilk test
shapiro_test_modified <- shapiro.test(tension_bond_data$Modified_Mortar)
shapiro_test_unmodified <- shapiro.test(tension_bond_data$Unmodified_Mortar)
cat("Shapiro-Wilk Test for Normality:\n")
print(shapiro_test_modified) # Test for Modified Mortar
print(shapiro_test_unmodified) # Test for Unmodified Mortar

# Plot Q-Q plots for both samples
par(mfrow = c(1, 2)) # Plot side by side
qqnorm(tension_bond_data$Modified_Mortar, main = "Q-Q Plot: Modified
Mortar")
qqline(tension_bond_data$Modified_Mortar, col = "blue")

qqnorm(tension_bond_data$Unmodified_Mortar, main = "Q-Q Plot: Unmodified
Mortar")
qqline(tension_bond_data$Unmodified_Mortar, col = "blue")

# Load necessary libraries
if (!require(car)) install.packages("car", dependencies = TRUE)
if (!require(ggplot2)) install.packages("ggplot2", dependencies = TRUE)

library(car)
library(ggplot2)

# 2. Check equal variance using Levene's Test
levene_test <- leveneTest(values ~ ind, data = long_data)

cat("Levene's Test for Equal Variance:\n")
print(levene_test)

# 3. Perform Bartlett's Test for Equal Variance
bartlett_test <- bartlett.test(values ~ ind, data = long_data)

cat("Bartlett's Test for Equal Variance:\n")
print(bartlett_test)

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