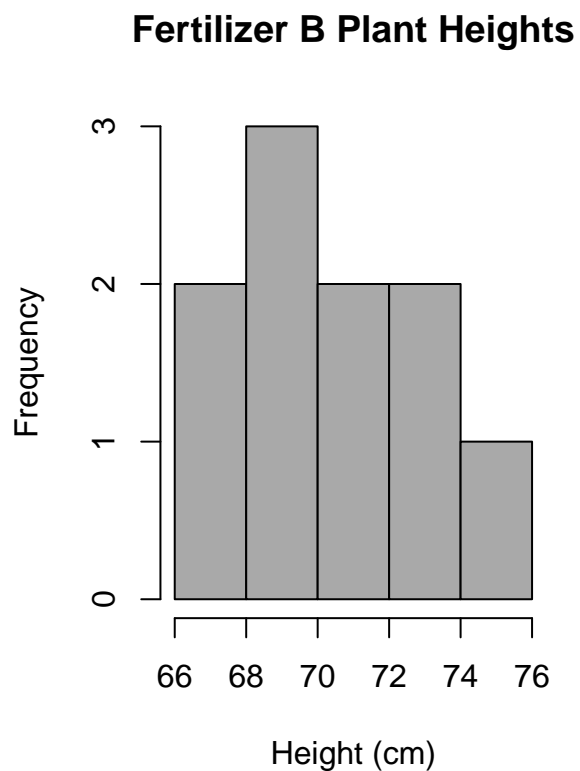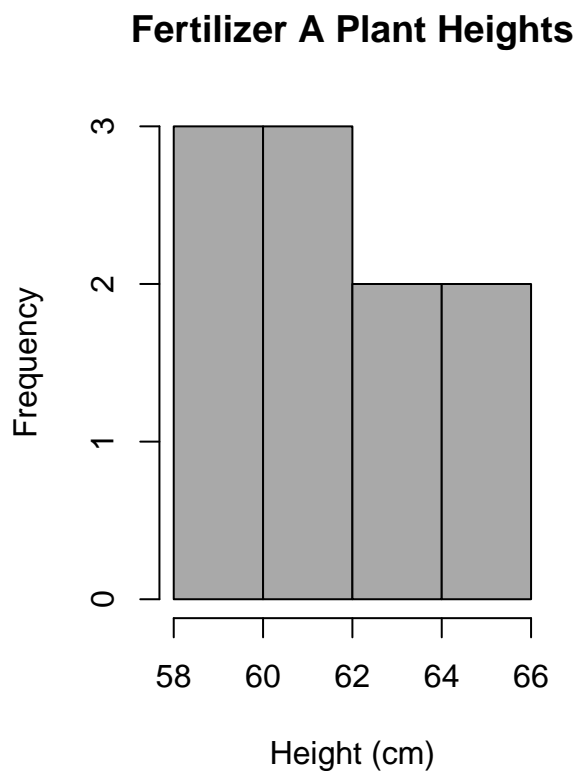# Homework 8

2023-12-08

```r
# Data
data_A <- c(62, 65, 58, 60, 64, 61, 63, 59, 66, 62)
data_B <- c(68, 72, 70, 71, 69, 73, 67, 70, 75, 74)

# Creating histograms
par(mfrow = c(1, 2))

# Histogram for Fertilizer A
hist(data_A, breaks = 5, col = "darkgray",
     main = "Fertilizer A Plant Heights", xlab = "Height (cm)",
     ylab = "Frequency")

# Histogram for Fertilizer B
hist(data_B, breaks = 5, col = "darkgray",
     main = "Fertilizer B Plant Heights",
     xlab = "Height (cm)")
```

```r
# Performing a t-test
t_test_result <- t.test(data_A, data_B)
t_test_result
```

```
##
##  Welch Two Sample t-test
##
## data:  data_A and data_B
## t = -7.6789, df = 17.999, p-value = 4.372e-07
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -11.335026  -6.464974
## sample estimates:
## mean of x mean of y
##      62.0      70.9
```

The negative t-statistic indicates that plants treated with Fertilizer B are, on average, taller than those treated with Fertilizer A.

The extremely low p-value suggests that this difference is statistically significant and not due to random chance.

The 95% confidence interval for the difference in means does not include zero, reinforcing the conclusion that there is a significant difference.

The sample means show that plants treated with Fertilizer B are, on average, about 8.9 cm taller than those treated with Fertilizer A.

```r
#install.packages("BayesFactor")
library(BayesFactor)
```

```
## Warning: package 'BayesFactor' was built under R version 4.2.3
```

```
## Loading required package: coda
```

```
## Loading required package: Matrix
```

```
## Warning: package 'Matrix' was built under R version 4.2.3
```

```
## ************
## Welcome to BayesFactor 0.9.12-4.6. If you have questions, please contact Richard Morey (richarddmorey
##
## Type BFManual() to open the manual.
## ************
```

```r
# Performing Bayesian t-test
bayes_test_result <- ttestBF(x = data_A, y = data_B)
bayes_test_result
```

```
## Bayes factor analysis
## --------------
## [1] Alt., r=0.707 : 22550.34 ±0%
```

```
## 
## Against denominator:
##    Null, mu1-mu2 = 0
## ---
## Bayes factor type: BFindepSample, JZS
```

Bayes Factor is 22550.34.

The Bayes Factor significantly favors the alternative hypothesis (true difference in means is not equal to zero) over the null hypothesis.

A Bayes Factor greater than 1 indicates evidence against the null hypothesis, and in this case, the value is extremely high, providing strong evidence for a difference in mean heights between the two groups.

Overall Conclusion:

Both the Welch Two Sample t-test and the Bayesian analysis provide strong evidence that there is a significant difference in the mean height of plants treated with the two different fertilizers, with Fertilizer B leading to taller plants on average compared to Fertilizer A. This conclusion is robust across both frequentist and Bayesian statistical methods.