

Project 3

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1. This experiment focuses on investigating Body Length as the factor variable, with three levels: 2.5, 3.5, and 4.5. The response variable we are observing is the Flight Time. To ensure randomization, we measured the flight time randomly for each level. It's important to note that there could be variations in the way the helicopter is thrown, introducing potential errors in the measurements.

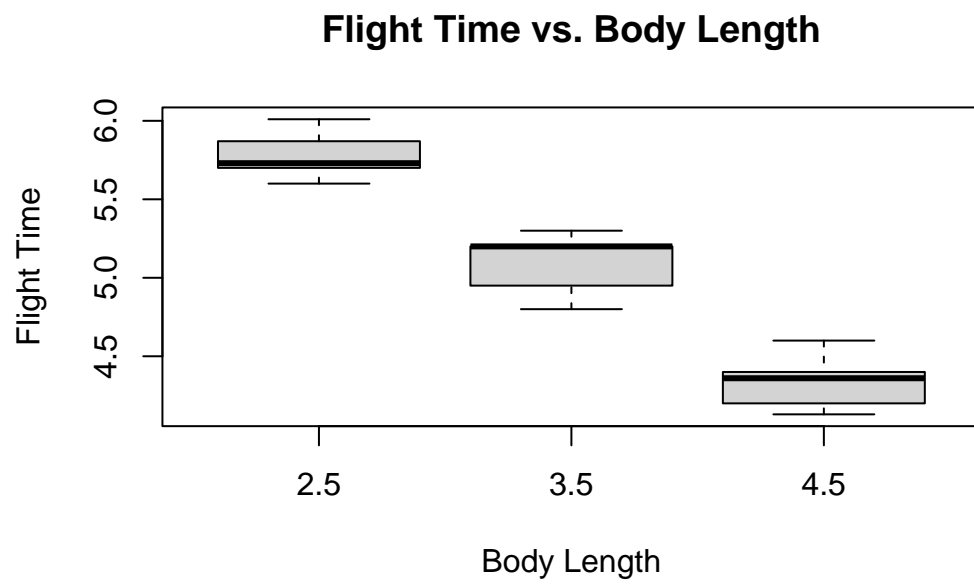
2. Hypothesis

$H_0 : \mu_s = \mu_L = \mu_B$

$H_A : \text{at least one } \mu \text{ is different}$

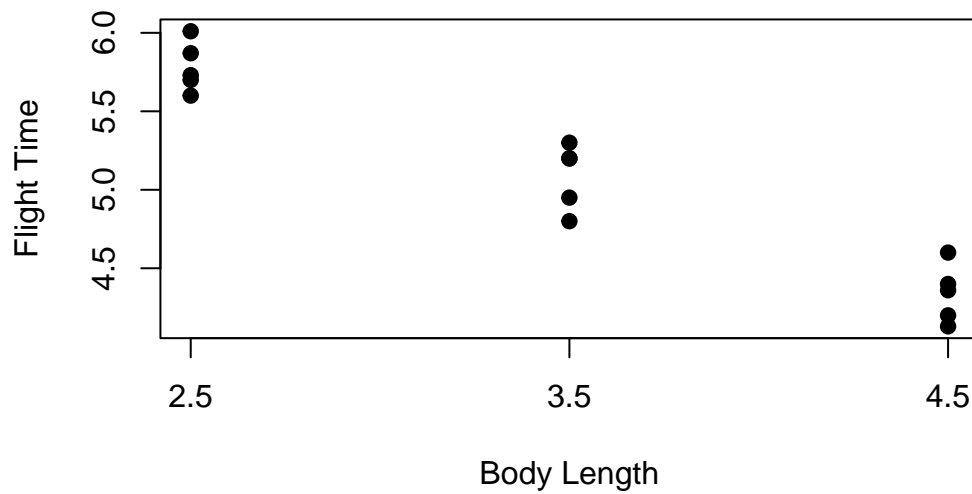
3. Plot

```
library(readxl)
hs <- read_excel("/Users/danielmilinga/Library/CloudStorage/OneDrive-CapitalUniversity/STA
hs$Body_Length <- as.factor(hs$Body_Length)
model.aov <- aov(hs$`Flight_Time`~hs$Body_Length)
boxplot(hs$Flight_Time ~ hs$Body_Length, main = "Flight Time vs. Body Length", xlab = "Bod
```



```
stripchart(hs$`Flight_Time`~hs$Body_Length, vertical = TRUE, pch = 19, main = "Strip Chart")
# X-axis label
xlab = "Body Length",
# Y-axis label
ylab = "Flight Time")
```

Strip Chart of Flight Time vs. Body Length



4. ANOVA Table

```
summary(model.aov)
```

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
hs\$Body_Length	2	5.216	2.6079	76.41	1.49e-07 ***
Residuals	12	0.410	0.0341		

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

5. Residual Plots

```
# Assuming 'hs' is your dataset and you've already performed ANOVA  
# (previous code for ANOVA should be run)
```

```
# Assuming 'model.aov' is your ANOVA model object
```

```
# Extract residuals from the ANOVA model  
residuals <- residuals(model.aov)
```

```
# Create residual plots
```

```

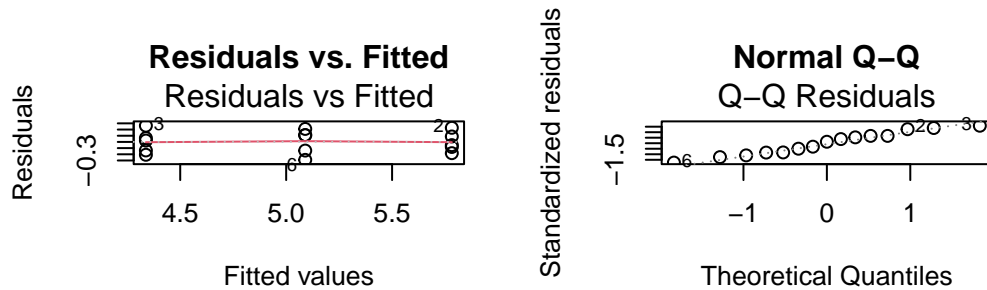
par(mfrow = c(2, 2)) # Set up a 2x2 grid for multiple plots

# Residuals vs. Fitted values plot
plot(model.aov, which = 1, main = "Residuals vs. Fitted")

# Normal Q-Q plot
plot(model.aov, which = 2, main = "Normal Q-Q")

# Reset the plotting layout
par(mfrow = c(1, 1))

```



Each point showed independence since the measurement were done randomly. From the Residual vs Fitted plot there is roughly equal variance among the measure points, meaning that the spread of the residuals (the differences between observed and predicted values) is roughly consistent across all levels of the independent variable. The Q-Q plot is a straight line showing that the distribution of residuals is close to normal.

7.

Multiple comparisons is not appropriate.