Lab5

For this lab we will be starting to think about analyzing our airplane data. Clean the `Airplane` dataset and recreate a figure similar to lab 2.

```
airplane <- read_csv("https://raw.githubusercontent.com/stat441/Labs/main/airplane_clean.csv")

airplane_wide <- airplane %>%
  mutate(value = feet_dec) %>%
  dplyr::select(-feet_dec) %>%
  pivot_wider(names_from = name, values_from = value)
```

Data Visualization

```
airplane %>%
  ggplot(aes(y = feet_dec, x = name, label = id)) +
  geom_violinhalf() +
  geom_boxplot(width=0.1) +
  geom_text(position = position_jitter(seed = 1)) +
  theme_minimal() +
  ylab('Distance traveled (feet)') +
  xlab('Airplane Type') +
  ggtitle('Airplane Distance from STAT441/541 Experiment')
```

1. Write out the statistical model suggested implied by the following code.

```
lm(feet_dec ~ name, data = airplane) %>% display()
```

```
## lm(formula = feet_dec ~ name, data = airplane)
##             coef.est coef.se
## (Intercept) 13.30     1.07
## nameGlider  -5.22     1.51
## ---
## n = 40, k = 2
## residual sd = 4.78, R-Squared = 0.24
```

2. Write out the statistical model suggested implied by the following code.

```
lm(feet_dec ~ name - 1, data = airplane) %>% display()
```

```
## lm(formula = feet_dec ~ name - 1, data = airplane)
##            coef.est coef.se
## nameDart   13.30     1.07
## nameGlider  8.08     1.07
## ---
## n = 40, k = 2
## residual sd = 4.78, R-Squared = 0.85
```

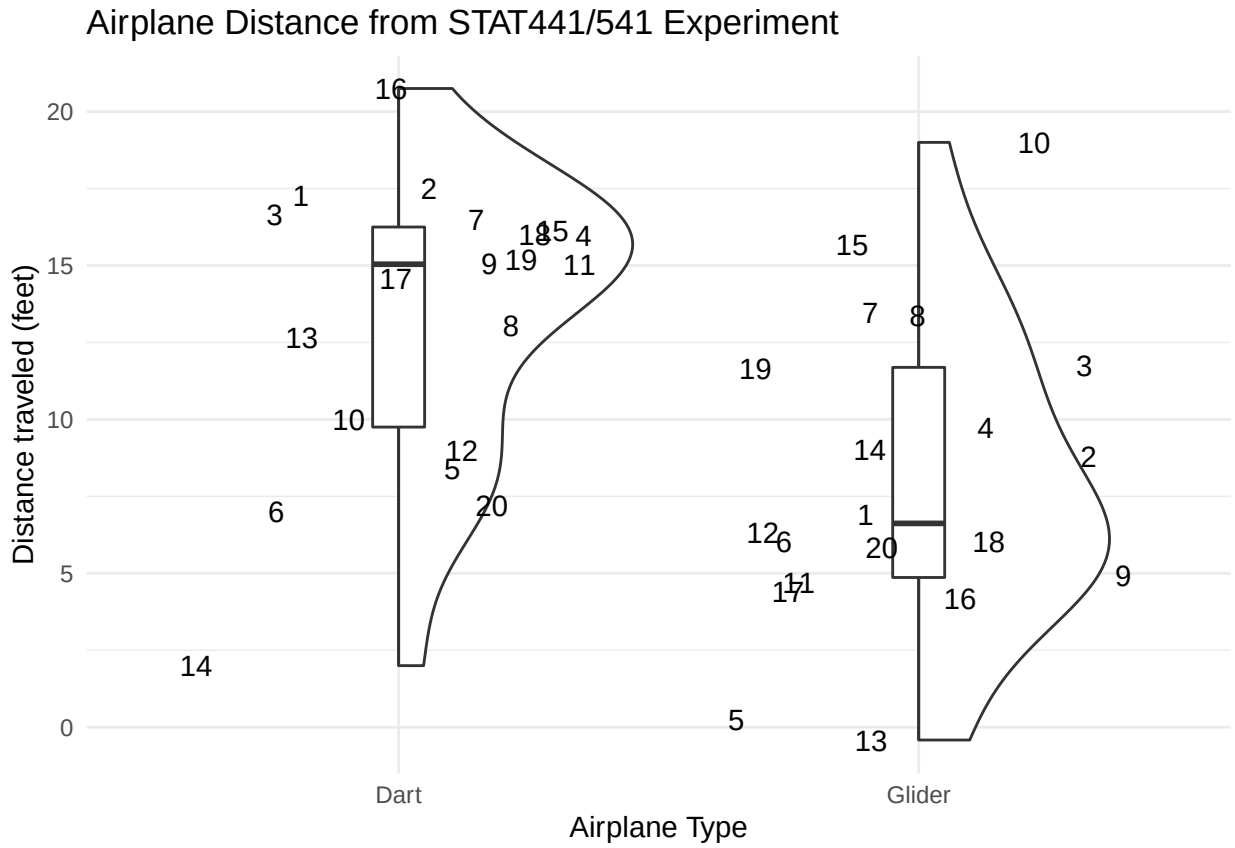

Figure 1: Distance traveled for paper airplane in STAT 441 / 541 experiment. Numbers represent unique paper airplane maker/throwers.

3. Do the statistical models in Q1 and Q2 account for the blocking structure of our designed experiment? If not, evaluate a model to include this factor using the reference case specification of Q1. Note: you don't need to write out the model notation, just fit this model.

```
display(lm(feet_dec ~ name + factor(id), data = airplane))
```

```
## lm(formula = feet_dec ~ name + factor(id), data = airplane)
##              coef.est coef.se
## (Intercept)  14.69     3.30
## nameGlider   -5.22     1.44
## factor(id)2   1.07     4.55
## factor(id)3   2.13     4.55
## factor(id)4   0.79     4.55
## factor(id)5  -7.76     4.55
## factor(id)6  -5.58     4.55
## factor(id)7   2.92     4.55
## factor(id)8   1.17     4.55
## factor(id)9  -2.08     4.55
## factor(id)10  2.42     4.55
## factor(id)11 -2.23     4.55
## factor(id)12 -4.41     4.55
## factor(id)13 -5.95     4.55
## factor(id)14 -6.58     4.55
## factor(id)15  3.84     4.55
## factor(id)16  0.38     4.55
## factor(id)17 -2.58     4.55
## factor(id)18 -1.08     4.55
## factor(id)19  1.34     4.55
## factor(id)20 -5.58     4.55
## ---
## n = 40, k = 21
## residual sd = 4.55, R-Squared = 0.66
```

4. Analyze the data using a paired t-test

```
#t.test(x = , y = , paired = T)
```

5. Analyze the data using a t-test on the difference (Dart - Glider) for each participant

6. Which of the analyses Q1 - Q5 provide the same inferences from the experiment?