Q1 (4 points)

Q1 3.5

1. What type of statistical test will you use? (1 pt)
   - I will use the ANOVA statistical test.

Remember to specify which type of ANOVA you would use (ex. One-way ANOVA) -0.5

2. Why? (1 pt)
   - I'm using ANOVA because there are multiple groups of insects that are being compared.
3. What is your independent variable(s)? (1 pt)
   - The independent variable is the spray type of insecticide treatment.
4. What is your dependent variable(s)? (1 pt)
   - The dependent variable is the number of insects.

Q2 (2 points)

5. Look at your histograms, boxplots, and normality test(s) - reproduce them. Do they indicate any violations of the assumptions for parametric tests? If so, what is indicated? (2 pts)

Q2 2

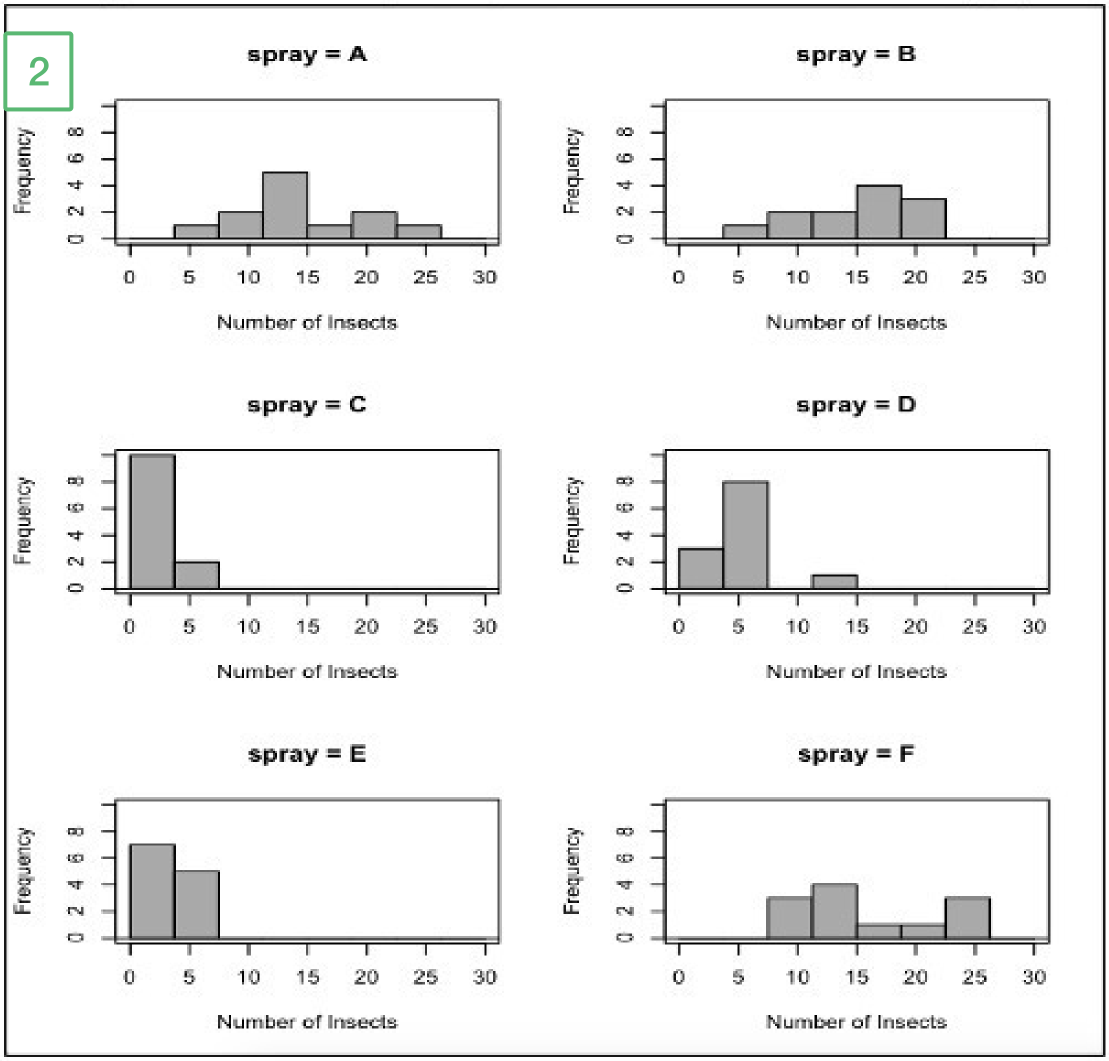


Figure 1. The sample populations were grouped according to the spray treatment type. None of the sample populations show distribution normality. Instead, sample populations show skewness in their individual distributions.

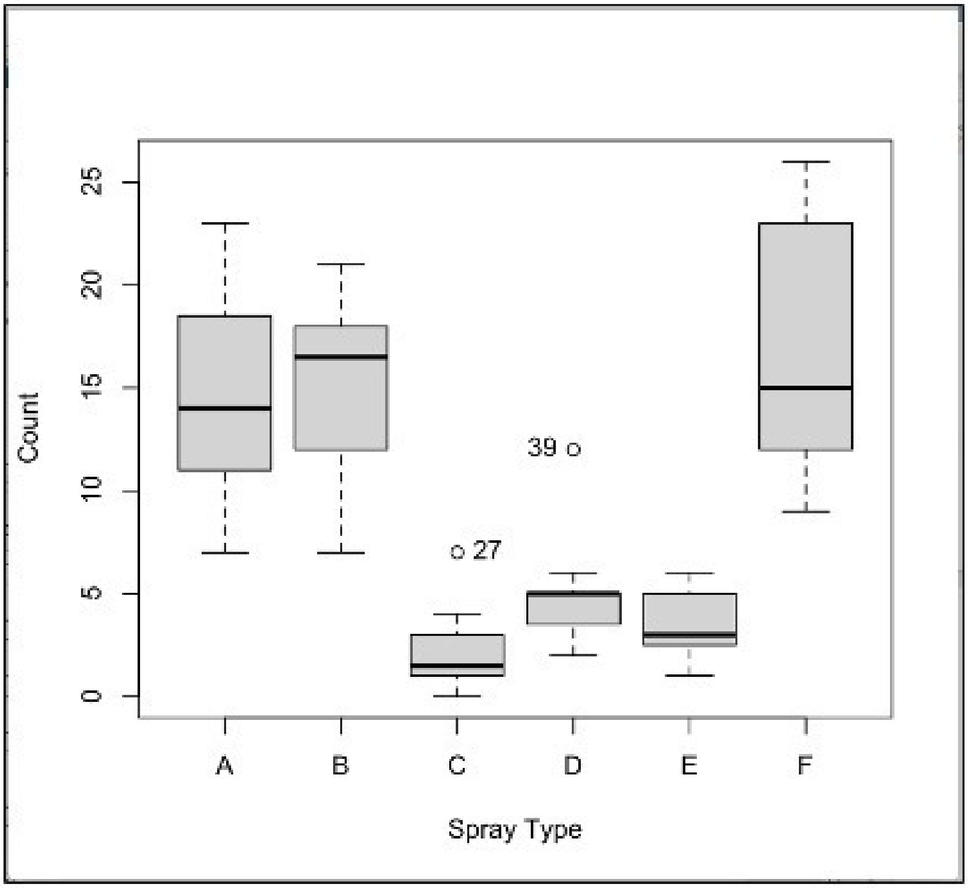


Figure 2. Each sample population have different median values. Sample population F has the greatest variability while sample population D has the least variability. Sample population A has the largest outliers.

Shapiro-Wilk normality test

p-values adjusted by the Holm method:

	unadjusted	adjusted
A	0.7487293	1.000000
B	0.6414703	1.000000
C	0.0475894	0.237947
D	0.0027132	0.016279
E	0.2966693	0.890008
F	0.1008638	0.403455

Lilliefors (Kolmogorov-Smirnov) normality test

p-values adjusted by the Holm method:

	unadjusted	adjusted
A	0.1574269	0.7745203
B	0.6235727	0.7745203
C	0.1600163	0.7745203
D	0.0013181	0.0079088
E	0.2233698	0.7745203
F	0.1549041	0.7745203

Both the Shapiro-Wilk and Lilliefors normality test show that some samples have a p-value that is less than 0.05. Every sample that has a p-value less than 0.05 has a non-normal distribution.

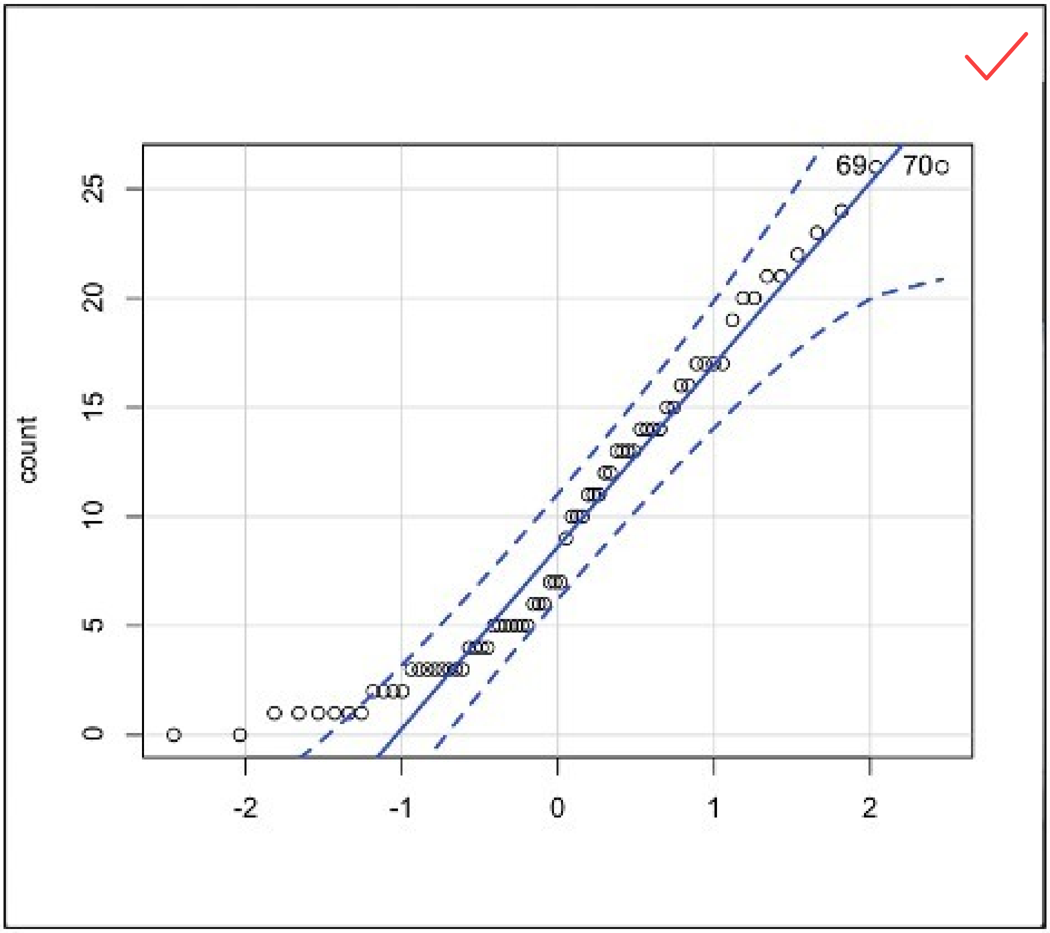


Figure 3. The QQ-plot of the Insecticide experiment shows a graph of non-normality. Some data points lie outside the compatibility interval.

To sum up: The tests performed all indicate a violation of the assumptions for parametric tests. The tests show that assumption 1 - having normal distribution in the sample means and the grand mean – was violated.

Q3 (2 points)

Q3 2

6. Based on your answer, take the appropriate steps to try to meet the assumptions for parametric tests. Proceed with step 7 regardless of whether your attempt to meet parametric assumptions worked, but use response data that are as normal as possible. (2 pts)
    - Insecticides$Transform_count <- with(Insecticides, log(count+1))

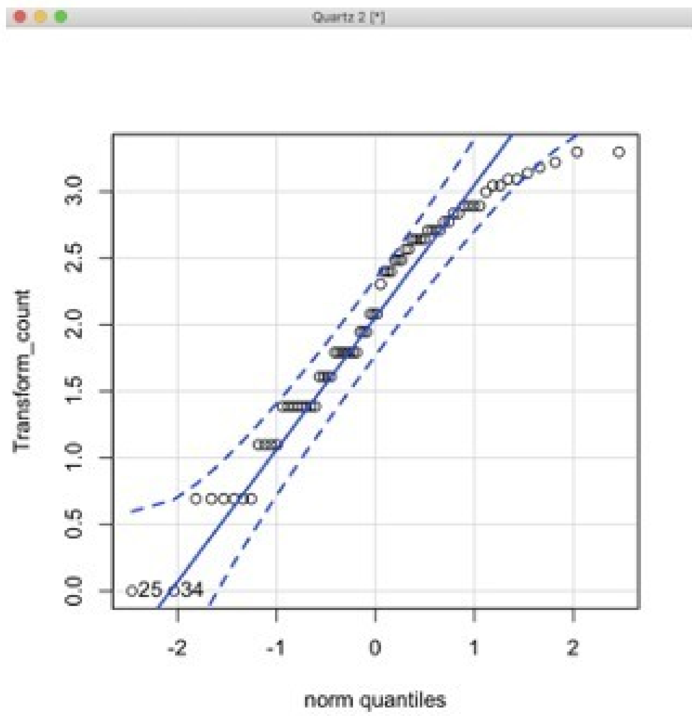


Figure 4. The QQ-plot after transformation still shows non-normality of the grand mean distribution. Some data points lie outside the compatibility interval.

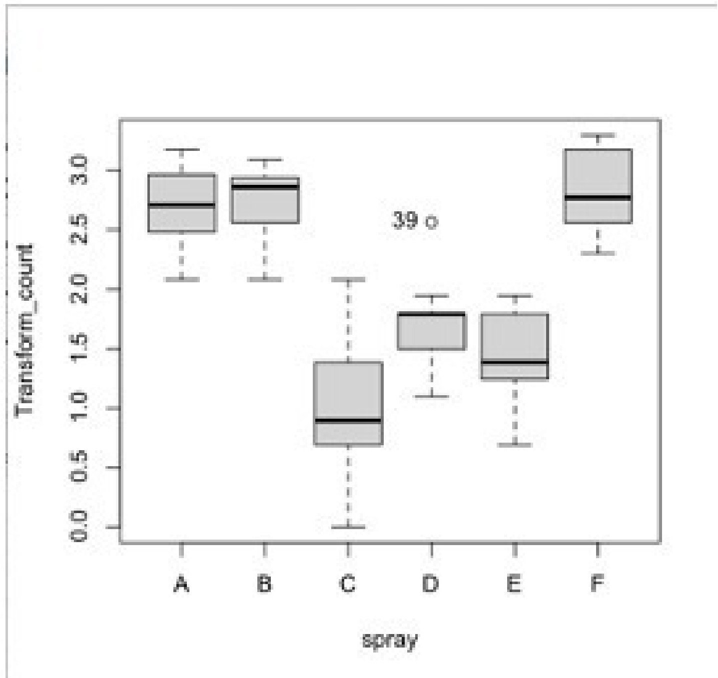


Figure 5. The boxplot after transformation still shows non-normality.
The median values still differ.

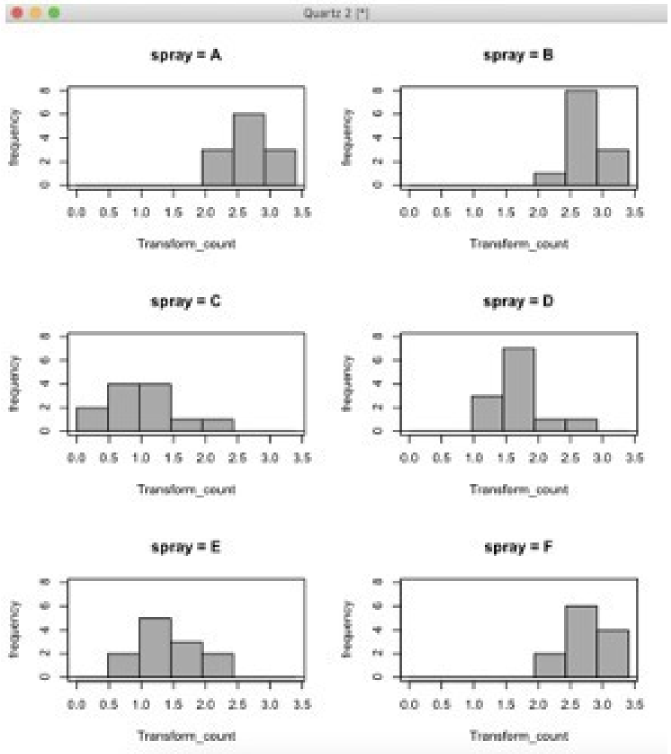


Figure 6. The histograms of each sample population after transformation still shows non-normality. Most sample populations still show skewness in distribution.

Q4 (2 points)

Q4 2

Perform the appropriate test and print the relevant Rcmdr output & figures for your statistical test. (2 pts)

Levene's test

leveneTest(Transform_count ~ spray, data=Insecticides, center="mean")

Levene's Test for Homogeneity of Variance (center = "mean")

```
      Df F value Pr(>F)
group  5  1.9972 0.0905 .
      66
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

ANOVA:

```
> oneway.test(Transform_count ~ spray, data=Insecticides) # Welch test
    One-way analysis of means (not assuming equal variances)
data:  Transform_count and spray
F = 39.053, num df = 5.00, denom df = 30.62, p-value = 2.133e-12
```

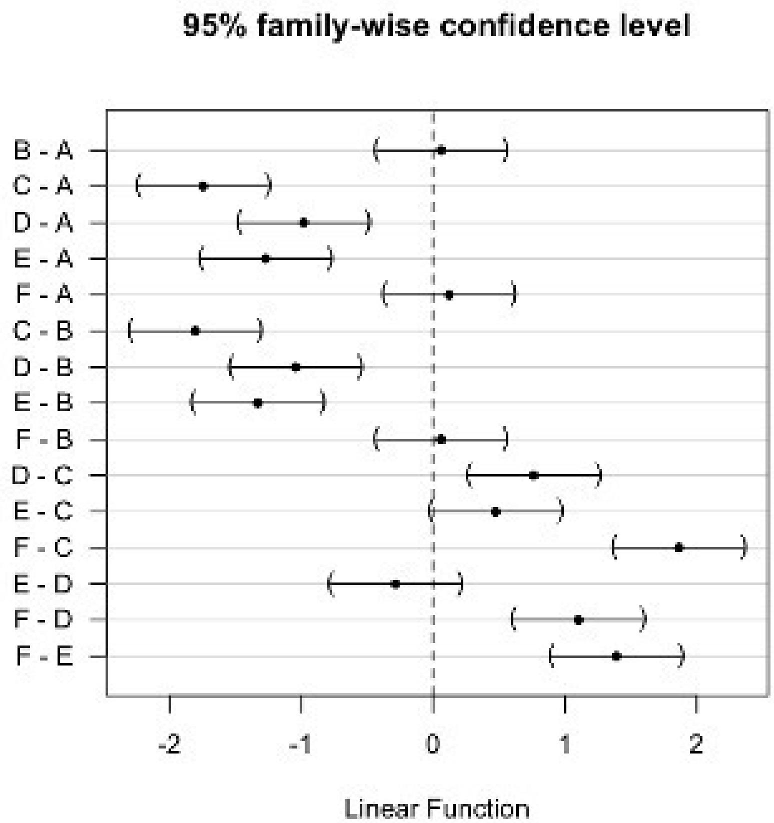
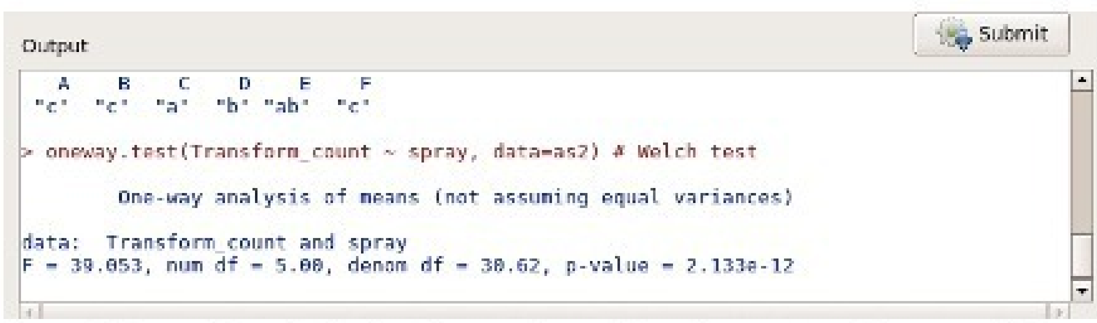


Figure 7. The post-Hoc analysis of the Insecticide experiment. The observed differences vary between each 2 samples that are being compared at once.



```
Output
   A    B    C    D    E    F
 "c"  "c"  "a"  "b" "ab"  "c"

> oneway.test(Transform_count ~ spray, data=as2) # Welch test

        One-way analysis of means (not assuming equal variances)

data:  Transform_count and spray
F = 39.053, num df = 5.00, denom df = 30.62, p-value = 2.133e-12
```

Figure 8. The post-Hoc analysis show that sample populations that were treated by sprays A, B and F show similarity. Sample population E show similarity with sample population A and with sample population C. Sample population A is different from sample population D, however.

Q5 (2 points)

Q5 0.75

t, report your results in the format of a scientific publication (2 pts)

Remember to include how the data was transformed (logarithmic? square root? etc.) -0.25

One-way ANOVA was used to determine whether there is a significa[nt difference] between the survival rates of the *Pyrausta nubilalis* insects when tre[ated with different] insecticides. The one-way ANOVA test revealed a critical value of F = 39.053 (at alpha = 0.05), which is a considerably large number. Thus, it can be concluded that there is significant difference between the survival rates of *Pyrausta nubilalis* if treated with different insecticides.

Remember to report the degrees of freedom (df) and p-value for ANOVA results -0.5

Remember to discuss significant findings about which sprays were most or least effective -0.5