WEEK 12 REPORT – ONE-WAY ANOVA

Group Number: 25
Date and Time of Tutorial Session: Wednesday 4: 5:30 pm
Group Members (First and Last name – no student numbers):

1. Katarzyna Fraser
2. Annika Tran
3. Ella Pustil
4. Hanna Asin
5.

Graded out of 10 marks.

1. Create a box plot comparing the sleep duration of patients by different treatment groups. Label the axes appropriately. <u>At the end of the activity, complete the figure by adding letter indicators for any significant differences between groups. Provide a descriptive figure caption.</u>
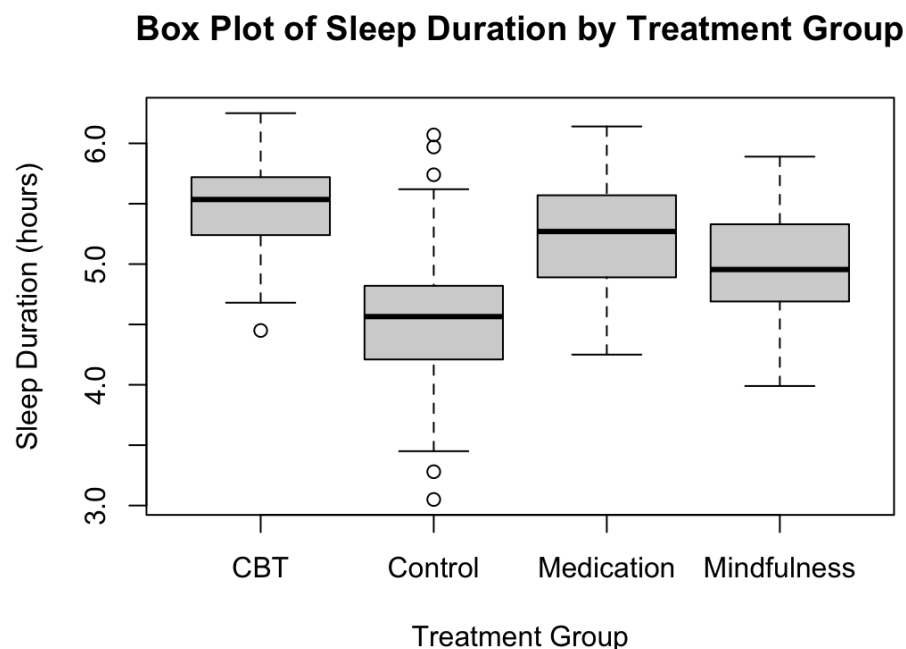(1.5 mark)

Figure 1. A boxplot of the sleep duration in hours difference between the 4 different types of treatment groups.

2. What are the null and alternative hypotheses for this test?
(1 mark)

Null Hypothesis (H0): The population means of sleep duration are the same across all the treatment groups.

Alternative Hypothesis (HA): At least one treatment group has a population mean of sleep duration that is different from the others.

3. Report the estimated LS mean for each treatment group from the RStudio output of your ANOVA.
(1 mark)

Control: 4.5534 hours
CBT: 5.4766 hours
Medication: 5.2584 hours
Mindfulness: 5.0024 hours

```
 Treatment  Sleep
       CBT 5.4766
   Control 4.5534
Medication 5.2584
Mindfulness 5.0024
```

4. What would an F-value approaching 1.0 indicate about how individual sleep duration varies by treatment groups?
(2 mark)

An F-value approaching 1.0 in the ANOVA test indicates that the variance between the treatment groups is similar to the variance within the treatment groups. This suggests that the treatment groups do not differ significantly in their mean sleep durations. Additionally, the variation we see in the data is significantly due to random variation within each group rather than differences caused by the treatment itself. In this case we would fail to reject the null hypothesis ($H0$) and would conclude that there is no significant effect of the treatment on sleep duration.

5. a) What is the statistical conclusion of your one-way ANOVA? Write your conclusion in text with the following in brackets: F-value (numerator df, denominator df), alpha, P-value).
(1 mark)

The one-way ANOVA results show a statistically significant difference in mean sleep duration among the treatment groups. We would fail to reject the null hypothesis ($H0$) and would conclude that there is no significant effect of the treatment on sleep duration.

F=33.23 (3,196), alpha= 0.5, p-value= 2e-16

b) What is the scientific conclusion of your one-way ANOVA?
(0.5 mark)

Our scientific conclusion of the one-way ANOVA is that the type of treatment significantly affects the sleep duration. This suggests that at least one treatment group leads to a different mean sleep duration compared to the others, indicating that the treatments are not equally effective in influencing one's sleep duration.

6. Report the results of your tests of the following model assumptions: homoscedasticity and normality of residuals. What do these tests suggest about the appropriateness of the ANOVA model for explaining variation in the data?
(1.5 mark)

The homoscedasticity p-value is 0.006892 is from the Bartlett test, and the normality of residuals p-value is 0.5239 from the Shapiro-Wilk test. Based on the p-value, doing the Bartlett test, it would reject the homoscedasticity but from the Shapiro-Wilk test it would fail to reject the normality of residuals. Even though the normality of residuals works for the ANOVA model, the homoscedasticity would not work and would be a violation. Thereofre the ANOVA model would not be appropriate for explaining variation in the data.

7. a) Provide one example of null and alternative hypotheses for one set of contrasts in your Tukey HSD test.
(0.5 mark)

Null Hypothesis ($H0$): The mean sleep duration of the CBT group is equal to the mean sleep duration of the control group.

Alternative Hypothesis (Ha): The mean sleep duration of the CBT group is different from the mean sleep duration of the control group

b) Summarize the statistical conclusion of your Tukey HSD test (all pairwise contrasts) in 2 or 3 sentences. Label your box plot with the results of your Tukey HSD test using textboxes (for full marks in Q1).
(1 mark)

The Tukey HSD test shows us that the CBT group had a significantly higher mean sleep duration compared to the control group, indicating that CBT is more effective at improving sleep duration than no treatment. Additionally, the medication group showed significantly higher mean sleep duration compared to the control group. However no

significant difference was found between the CBT and medication groups or between the mindfulness group and any other group, suggesting similar effectiveness among some of the treatments.
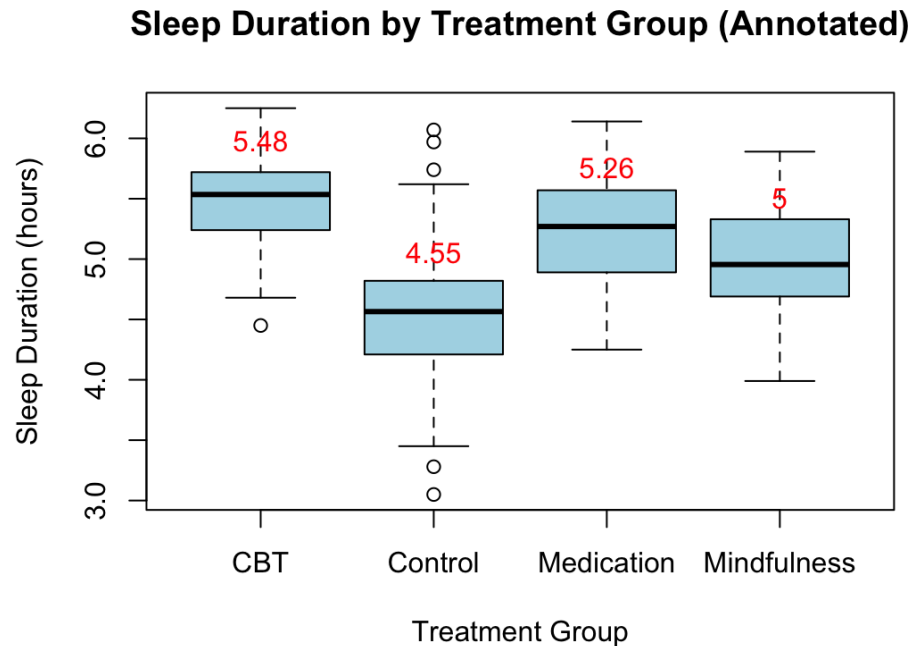
Sleep Duration by Treatment Group (Annotated)

Figure 2. A boxplot of the sleep duration in hours difference between the 4 different types of treatment groups with annotated LS mean in red.

CONGRATULATIONS ON COMPLETING YOUR FINAL TUTORIAL! THANK YOU FOR ALL OF YOUR HARD WORK THIS SEMESTER ☺

Notes:

- **Only one group member submits the report**
- **The report must be a Word .DOC, or .DOCX file.**
- **Make sure everyone in the group has a copy of the report**
- **Double check what you have submitted!!**
  - **view it on OnQ to make sure everything is there and visible**
- **Lastly, everyone in the group needs to submit their own version of the Rscript file.**