Homework 3

## Exercise 1:

1. **What is between-subject effect? What is within-subject effect?**

**Company** is the **between-subject effect**. This classic fixed effect. Different subjects are assigned to different levels of the factor. In this case, two companies have 10 different employees each.

**Time** is the **within subject effect**. This is repeated measure of dependent variable at different time points on the same subjects. In this case, work\_interest score is measured at three time points, namely 1st, 2nd, 3rd year taking same 20 employees for all 3 years.

1. **What kind of ANOVA would you perform to find Time and Company effect?**

Since Company is between-subject factor and time a within-subject factor we choose Mixed ANOVA since there is a violation of Independent samples assumption due to within-subject factor and Two-way ANOVA cannot be used.

1. **Fit the proper ANOVA with your choice of within-subject dependency structure and find which effect is insignificant based on Type 3 test**

From Mixed ANOVA for company and time with their interaction, based on Type 3 test, the interaction term is insignificant, the work\_interest score over time is not dependent on which company the employees are from and score across different companies doesn’t change over time.

The main effect for Company is statistically insignificant at p < 0.05 with a p-value 0.7038. We retain null. The means of the work\_interest score are not different across the two companies.

The main effect for time is significant at p < 0.05 with a p-value < .0001. The work\_interest score has significantly changed over time

1. **Refit the model after removing insignificant term you find in (c). Make a conclusion which main effect is significant in the final model**

The insignificant term company is removed, the final model shows time factor significant at p < 0.05 with a p-value < 0.0001. The work\_interest score is significantly different over time.

1. **State the differences in IWC across significant main effect groups through post-hoc test with Tukey’s adjustment. Make a short and clear conclusion based on your findings.**

The confidence intervals for all 3 group pairs for factor time do not include 0 which shows that all have significant work\_interest mean differences.

Post Hoc test shows that the work\_interest score has decreased over the years. The employees are not as interested in the 2nd year as they were in the 1st year and weren’t as interested in the 3rd year as they were in the 2nd year. Consequently, they weren’t interested in the 3rd year as they were in the 1st year.

## Exercise 2:

1. **To control (adjust) effect of plant height, what kind of ANOVA should we perform?**

We have a continuous dependent variable(y). Categorical independent variable(trt) and a continuous variable(x) as a means of control. We should perform ANCOVA since an additional continuous explanatory variable is added (to the variables of interest) as a means of control.

1. **Check Homogeneity of Slope assumption through Type 3 test. Is it okay to perform the model you state in (a)?**

The interaction between group variable (treatment choice) and covariate (plant height) is insignificant based on Type 3 test hence Homogeneity of slope is met. We can perform ANCOVA to test treatment choice effect on plant yield.

1. **Fit the model to find treatment effect based on your result in (b). What is your conclusion about treatment effect?**

Both the main effects, trt and x are highly significant. The treatment choice has a significant effect on plant yield. The plant height also has a significant effect on plant yield. The model is highly significant. By R2, we conclude 99.8% of variation in the plant yield is explained by the model. So the model is very useful.

1. **Comment on any significant group differences through post-hoc test with Tukey’s adjustment. What does this tell us about plant yield differences across trt groups? Describe your finding in a short sentence.**

All group individual means of trt factor are significant as they C.I. doesn’t include 0.

From the **Least Square Means Post -Hoc** test for Effect trt, we can conclude that all group mean differences in trt factor are significant as their C.I. doesn’t include 0. The slow fertilizer results in more plant yield than any other treatment choice. Then comes the control method followed by fast fertilizer treatment.

Slow fertilizer has 6.7 units more plant yield than fast fertilizer and 3.5 units more plant yield than control method that doesn’t use any treatment.

Without any fertilizer treatment the plant yield is 3 units more than fast fertilizer treatment.