

Homework 7

ANOVA

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Consider the Data in TraumaData.dat. The four groups are Stress inoculation therapy (SIT) group, Prolonged exposure (PE) group, Supportive counseling (SC) group (where participants learn a general problem solving technique) and Waiting list (WL) control group. The DV is a severity rating of symptoms, so smaller values are better outcomes.

Use R or SPSS for the following. If you use R, copy and paste your code and output. If you use SPSS, present output tables. Note: you have to add your own words to address the questions. Outputs alone are incomplete.

For R, remember to turn the IV into a factor before running your program. Double check the df in your ANOVA table.

```
library(dplyr)

df <- read.table("TraumaData.dat", header = TRUE)

# I am assuming 1 = SIT, 2 = PE, 3 = SC, and 4 = WL (control)
df$Group <- factor(df$Group, labels = c("SIT", "PE", "SC", "WL"))

df %>%
  group_by(Group) %>%
  summarize(mean = mean(Score),
            sd = sd(Score))
```

```
# A tibble: 4 x 3
  Group mean  sd
<fct> <dbl> <dbl>
1 SIT    10.9  4.48
2 PE     15.4  7.16
3 SC     18.1  7.13
4 WL     19.5  6.74
```

Run ANOVA, present ANOVA table and draw conclusion.

```
model <- aov(Score ~ Group, data=df)
summary(model)
```

```
          Df Sum Sq Mean Sq F value Pr(>F)
Group      3  475.9   158.63    3.783 0.0176 *
Residuals 40 1677.1    41.93
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

The results of the one-way ANOVA are significant, indicating that there is sufficient evidence to reject the null hypothesis that all the group means are equal. This means that at least one treatment had an effect on symptom severity.

Run Tukey's HSD for all pairwise comparisons at FWER = 0.05. Draw conclusions.

```
TukeyHSD(model)
```

```
Tukey multiple comparisons of means
 95% family-wise confidence level
```

```
Fit: aov(formula = Score ~ Group, data = df)
```

```
$Group
      diff      lwr      upr    p adj
PE-SIT 4.454545 -2.9461018 11.855193 0.3828467
SC-SIT 7.181818 -0.2188291 14.582465 0.0599940
WL-SIT 8.636364  1.2357164 16.037011 0.0165999
SC-PE  2.727273 -4.6733745 10.127920 0.7571663
WL-PE  4.181818 -3.2188291 11.582465 0.4385076
WL-SC  1.454545 -5.9461018  8.855193 0.9520888
```

There is one significant pairwise comparison, between the control (WL) and the stress inoculation therapy (SIT) treatment groups. SIT reduces symptom severity compared to the control group.

Using Tukey's HSD to protect family-wise error rate, there is insufficient evidence to support the efficacy of any other treatment.

Test the following family of two tests at $\text{FWER} = 0.05$ with Bonferroni correction:

To protect family-wise error rate of a family of 2 tests, we can use a Bonferroni-adjusted alpha value of 0.025.

average treatment compared to control

```
df$group_binary <- recode(df$Group,
                          "WL" = "control",
                          "SIT"="treatment",
                          "PE" = "treatment",
                          "SC" = "treatment")
t.test(Score ~ group_binary, data=df)
```

Welch Two Sample t-test

```
data: Score by group_binary
t = -2.0167, df = 17.469, p-value = 0.05936
alternative hypothesis: true difference in means between group treatment and group control is not equal to 0
95 percent confidence interval:
 -9.7246246  0.2094731
sample estimates:
mean in group treatment    mean in group control
          14.78788              19.54545
```

Controlling for family-wise error rate by setting our effective p-value cutoff to 0.025, there is no significant difference between the treatment and control groups.

average SIT and PE compared to SC, both in two-sided tests.

```
df.treatment <- subset(df, group_binary == "treatment")
df.treatment$sit_pe_sc <- recode(df.treatment$Group,
                                "SIT"="SIT_PE",
                                "PE" = "SIT_PE",
                                "SC" = "SC")
```

```
t.test(Score ~ sit_pe.sc, data=df.treatment)
```

Welch Two Sample t-test

data: Score by sit_pe.sc

t = -1.9574, df = 17.915, p-value = 0.06607

alternative hypothesis: true difference in means between group SIT_PE and group SC is not equal to 0

95 percent confidence interval:

-10.2742044 0.3651135

sample estimates:

mean in group SIT_PE	mean in group SC
13.13636	18.09091

Controlling for family-wise error rate by setting our effective p-value cutoff to 0.025, there is no significant difference between the SIT+PE treatment group and the SC treatment group.