Intro to Experimental Design

* The contents of an Experiment: The Three Decisions *Response, Treatment, Unit*
* The Three Sources of Variability *Variability due to the conditions of interest (Wanted) Variability in the measurement process (Unwanted) Variability in the experimental material and process (Unwanted)*
* The Three Kinds of Variability *Planned/systematic that we want, chance-like that we can live with and unplanned systematic variability that threatens disaster.*
* Four Different Types of Responses *Nominal – The measurement is the name of a category. (Eye color, blood type) Ordinal – The measurement sorts items into categories. (Color of beetles) Interval – The measurement is a number and the distance has no meaning. (Birthyear) Ratio – The measurement has a meaningful distance and lowest value. (ml)*

Chapter 5

* BF designs – when is it a CRD? *Tis a CRD when all variables present are randomized.*
* General decomposition rules (for estimated effects and df)
* Factor diagram and decomposition tables
* “ANOVA-doku” (filling in blanks in the tables)
* Notation for the Factor Structure

Chapter 6

* Decomposition / factor diagram of BF[2]
* Main effects
* Cell means and interaction effects

Section 11

* Why do we use multiple comparison procedures?
* Different types of comparisons and recommended approaches for each type
* Family-wise error rate

***PACKAGES***

library(package)

library(mosaic)

library(dplyr)

library(tidyverse)

library(ggplot2)

library(CARS)

library(pander)

library(MASS)

library(gplots)

library(car)

install.package("package")

***## BF[1] - Descriptive Statistics***

favstats(ivdata$Particles~ivdata$Companies)

par(mfrow=c(1,1))

plotmeans(ivdata$Particles ~ ivdata$Companies, error.bars="se")

## Parallel Dot Graph

par(mfrow=c(1,2))

stripchart(Particles ~ Companies, vertical=TRUE, method="stack", ylab="Particles", pch = 1, data=ivdata)

## Boxplots

boxplot(Particles~Companies, data=ivdata, id.method="y")

## Option 1 for doing QQ plots

par(mfrow=c(1,1))

qqmath(~Particles|Companies,data=ivdata)

## Option 2 for doing QQ plots

par(mfrow=c(1,3))

qqPlot(ivdata$Particles[ivdata$Companies == "Cutter"], dist="norm")

qqPlot(ivdata$Particles[ivdata$Companies == "Abbot"], dist="norm")

qqPlot(ivdata$Particles[ivdata$Companies == "McGaw"], dist="norm")

## Option 1 for doing Histogram

par(mfrow=c(1,1))

histogram(~Particles|Companies,data=ivdata)

## Option 2 for doing Histograms

par(mfrow=c(1,3))

hist(ivdata$Particles[ivdata$Companies == "Cutter"], scale="frequency", breaks="Sturges", col="darkgray")

hist(ivdata$Particles[ivdata$Companies == "Abbot"], scale="frequency", breaks="Sturges", col="darkgray")

hist(ivdata$Particles[ivdata$Companies == "McGaw"], scale="frequency", breaks="Sturges", col="darkgray")

***## BF[1] - Inferential Statistics***

womenpoet$type <- as.factor(womenpoet$type)

AnovaModel.2 <- aov(age ~ type, data=Womenpoet)

summary(AnovaModel.2)

AnovaModel.1 <- aov(Particles ~ Companies, data=ivdata)

summary(AnovaModel.1)

##option #1 Checking equal variance and normality

par(mfrow=c(1,2))

plot(AnovaModel.1, which=1:2)

***## Transformation***

AnovaModel.1 <- aov(arctan(Particles) ~ Companies, data=ivdata)

summary(AnovaModel.1)

##option #1 Checking equal variance and normality

par(mfrow=c(1,2))

plot(AnovaModel.1, which=1:2)

## When checking for transformations

favstats((ivdata$Particles)^(1/4)~ivdata$Companies)

***## BF[1] - Multiple Comparisons***

## load and install agricolae package

AnovaModel.1 <- aov(Particles ~ Companies, data=ivdata)

summary(AnovaModel.1)

## Rstudio with mosaic package

favstats(ivdata$Particles~ivdata$Companies)

## Rstudio

testwn <- scheffe.test(AnovaModel.1, "Companies", group = TRUE, console = TRUE)

#Fisher's LSD

pairwise.t.test(ivdata$Particles, ivdata$Companies, "none")

#Bonferroni

pairwise.t.test(ivdata$Particles, ivdata$Companies, "bonferroni")

#Tukeys

TukeyHSD(AnovaModel.1, "Companies")

***## CONTRASTS***

meconium$groups <- as.factor(meconium$groups)

fit.lm1 <- lm(meconium ~ groups, data= meconium)

summary(fit.lm1)

contrasts(meconium$groups) <- cbind(c(.5,.5,-1), c(1,-1,0))

contrasts(meconium$groups)

fit.lm1 <- lm(meconium ~ groups, data= meconium)

summary(fit.lm1)

***## BF[2] - Descriptive Statistics***

pigout <- read\_csv("Pig Out.csv")

View(pigout)

pigout$B12 <- as.factor(pigout$B12)

pigout$Antibiotics <- as.factor(pigout$Antibiotics)

favstats(pigout$WeightGain~pigout$Antibiotics)

favstats(pigout$WeightGain~pigout$B12)

par(mfrow=c(3,2))

boxplot(WeightGain~B12, data=pigout, id.method="y")

boxplot(WeightGain~Antibiotics, data=pigout, id.method="y")

interaction.plot(pigout$B12,pigout$Antibiotics, pigout$WeightGain)

interaction.plot(pigout$Antibiotics,pigout$B12, pigout$WeightGain)

plotmeans(pigout$WeightGain~pigout$Antibiotics, error.bars="se")

plotmeans(pigout$WeightGain~pigout$B12, error.bars="se")

***## BF[2] - Inferential Statistics***

pigout$Antibiotics <- as.factor(pigout$Antibiotics)

pigout$B12 <- as.factor(pigout$B12)

## Either group of Anova commands work for this

##option #1 Checking equal variance and normality

par(mfrow=c(1,2))

plot(AnovaModel.1, which=1:2)

***## TRANSFORMATIONS***

favstats(log(pigout$WeightGain)~pigout$Antibiotics)

favstats(log(pigout$WeightGain)~pigout$B12)

AnovaModel.2 <- (lm(WeightGain ~ Antibiotics\*B12, data=pig))

Anova(AnovaModel.2)

##option #1 Checking equal variance and normality

par(mfrow=c(1,2))

plot(AnovaModel.2, which=1:2)

***BF[2] - Type III Sum of Squares***

cancer326$gender <- as.factor(cancer326$gender)

## This gives us Type I Sum of Squares in R

AnovaModel.1 <- anova(lm(days ~ type\*gender, data=cancer326))

AnovaModel.1

## This gives us Type III Sum of Squares in R

cancer.lm2 <- lm(days~gender\*type, data=cancer326, contrasts=list(type=contr.sum, gender=contr.sum))

Anova(cancer.lm2, type="III")

Variability?

Effect Sizes?

Transformations and how to do them?

Factor Structure Notation?