ADA2 HW3: Ch 05

Due Thursday 02/28/2019

Problem 1: Randomized Complete Block Design (RCBD)

A fast food franchise is test marketing 3 new menu items. To find out if they have the same popularity, 6 franchisee restaurants are randomly chosen for participation in the study. In accordance with the randomized block design, each restaurant will be test marketing all 3 new menu items. Furthermore, a restaurant will test market only one menu item per week, and it takes 3 weeks to test market all menu items. The testing order of the menu items for each restaurant is randomly assigned as well. The table represents the sales figures of the 3 new menu items in a restaurant after a week of test marketing.

```
dat <- read.table(text="
Restaurant Item1 Item2 Item3
A          31    27    24
B          31    28    31
C          45    29    46
D          21    18    48
E          42    36    46
F          32    17    40
", header = TRUE)
```

(1) Reshape and plot the data, draw boxplot of sales v.s. items, boxplot of sales v.s restaurants and interaction plot. Describe what you have seen from the plots.

(2) Fit randomized block model, list type 3 anova table

(3) Assess model assumptions

(4) State and interpret the hypothesis test for difference in Item mean sales

(5) If appropriate, perform pairwise comparisons with Tukey HSD correction

(6) What is your recommendation to the Franchise?

Problem 2: Kangaroos skull measurements: mandible length

The data to be analyzed here are selected skull measurements on 148 kangaroos of known sex and species. There are 11 columns of data, corresponding to the following features. The measurements are in meters/10000 (mm/10).

column | Variable name | Description

1 *| sex | sex (1=M, 2=F)

2 *| species | species (0=M. giganteus, 1=M.f. melanops, 2=M.f. fuliginosus)

3 | pow | post orbit width

4 | rw | rostal width

5 | sopd | supra-occipital - paroccipital depth

6 | cw | crest width

7 | ifl | incisive foramina length

8 *| ml | mandible length

9 | mw | mandible width

10 | md | mandible depth

11 | arh | ascending ramus height

Some of the observations in the data set are missing (not available). These are represented by a period `.`, which in the `read.table()` function is specified by the `na.strings = "."` option.

```
fn.data <- "http://statacumen.com/teach/ADA2/worksheet/ADA2_WS_09_kang.txt"
kang <- read.table(fn.data, header=TRUE, na.strings = ".")

# subset only our columns of interest
kang <- subset(kang, select = c(sex, species, ml))

# remove observations with missing values
n.start <- nrow(kang)
kang <- na.omit(kang)
n.keep <- nrow(kang)
n.drop <- n.start - n.keep  #number of observations dropped
cat("Removed", n.start, "-", n.keep, "=", n.drop, "observations with missing values.")
```

```
## Removed 148 - 136 = 12 observations with missing values.
```

```
# make dose a factor variable and label the levels
kang$sex     <- factor(kang$sex    , labels = c("M","F"))
kang$species <- factor(kang$species, labels = c("Mg", "Mfm", "Mff"))

# The first few observations
head(kang)
```

```
##   sex species   ml
## 1   M      Mg 1086
## 2   M      Mg 1158
## 3   M      Mg 1131
## 4   M      Mg 1090
## 5   M      Mg 1175
## 6   M      Mg  901
```

(1) Draw side-by-side boxplot of mean mandible lengths across the 6 combinations of sex and species. Interpret boxplot, distributional centers and shapes.

(2) Draw Profile plots (you can draw it with boxplots), do the profile plots suggest that there is an interaction?

(3) Fit the two-way interaction model, Test for the presence of interaction between sex and species. Also test for the presence of main effects, effects due to the sex and species.

(4) Check model assumptions for full model (3)

(5) If the model can be simplified (such as interaction is not significant), then refit the model with only the main effects. test assumptions. Test whether the main effects are significant, reduce further if necessary. Test model assumptions. Suggest a final model to use.

(6) Summarize the differences if any, in sexes and species using relevant multiple comparisons. Give clear interpretations of any significant effects.