ISTA 370, Fall 2015

HW4, Due Sunday, Nov 1st, 11:59 PM

October 26, 2015

In HW3 we looked at how to do one-way analysis of variance and how to write those results in APA-style. Here we will correct our mistakes and will look at two-way analysis of variance. As you saw earlier, it is very hard to draw any conclusions from the one-way ANOVA when there are multiple levels of independent variables together. For example, the whole dataset can be partitioned based on gender and within each gender we can partition based on propensity to lie, sexual permissiveness, scale of sexual permissiveness, etc. Two-way analysis of variance involves 2 independent variables, hence, two-way. In case of three independent variables, it will be three-way, and so on.

Two-way ANOVA gives out two major results: main effect (the effect of the independent variables) and interaction effect (how the independent variables affect each other). The concept of the interaction effect makes the two-way ANOVA very interesting. Sometimes, the independent variables don't affect the dependent variable just by themselves, but they affect each other, and in combination they affect the dependent variable. The same can be said about n-way ANOVA ($n >1$).

1 Two-way ANOVA

Let's look at how to do the two-way ANOVA in R. We can take the problem number 3 from HW3.

- Which gender has a higher propensity to lie, irrespective of the scale of premarital sexual permissiveness? Report the results from the analysis of variance in APA-style and write a statement of your conclusions – check what needs to be reported and how.

```r
# The reason why this is a two-way ANOVA: We have
# 2 independent variables: Gender and Propensity
# to lie. These two variables are listed as gender
# and lies in the dataset.

# First load the dataset
sex_lies <- read.table("sex_lies.txt", header = TRUE, sep = "")

# Given we are now looking at both the independent
# variables together, we don't need to partition the
# dataset based on one variable. We can do the two-way
# ANOVA right off the bat!
aov.gender.lies <- aov(count~gender*lies,data=sex_lies)
summary(aov.gender.lies)

##             Df Sum Sq Mean Sq F value Pr(>F)
## gender       1   2627  2626.6   6.547  0.013 *
## lies         1     16    16.0   0.040  0.842
## gender:lies  1    256   256.0   0.638  0.428
## Residuals   60  24071   401.2
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

# Look carefully what changed in the aov function. Count is
# our dependent variable, gender and lies are our independent
# varaibles.
print(model.tables(aov.gender.lies, "means"),digits=3)

## Warning in replications(paste("~", xx), data = mf):  non-factors
ignored:  gender
## Warning in replications(paste("~", xx), data = mf):  non-factors
ignored:  lies
## Warning in replications(paste("~", xx), data = mf):  non-factors
ignored:  gender, lies

## Tables of means
```

```
## Grand mean
##
## 35.59375
##
##  gender
## gender
##    1    2
## 42.0 29.2
##
##  lies
## lies
##    1    2
## 35.1 36.1
##
##  gender:lies
##       lies
## gender 1    2
##      1 43.5 40.5
##      2 26.7 31.7
```

The summary produced by two-way ANOVA consists of four rows. The first three are our major concerns. The first row shows the effect of only the gender on the counts, while the second row shows the effect of only the propensity to lie. The third row shows the interaction effect: effect of both, gender and propensity to lie, and how they together affect the counts.

As we can see, there is only one significant result and that is the effect of gender. You can see that for gender, the p value is less than 0.05 and the summary marks the significant effect with an asterisk. Based on these results you can say that there is a significant effect of gender ($F(1, 60) = 6.54, p = 0.01$), showing that the count of males ($M = 29.2$) and females ($M = 42.0$) are significantly different. However, there is no effect of propensity to lie on the counts and there is no interaction effect (p-values$>$0.05).

2 Questions

Let's repeat some of the analyses from HW3 but now using two-way ANOVA.

1. (15 Points) What can you tell us about the propensity to lie among different scales of premarital sexual permissiveness (there are 4 different ones) irrespective of gender. Write your results in APA-format. **Hint**: There are two independent variables: scale and lies.

2. (15 points) What can you tell us about premarital sexual permissiveness among different scales of premarital sexual permissiveness irrespective of the gender. Write your results in APA-format. **Hint**: There are two independent variables: scale and sex.

3. (20 points) What can you tell us about religiosity among different scales of sexual permissiveness among different genders? Write your results in APA-format. **Hint**: This is a three-way ANOVA. There are three independent variables: gender, scale, and religion.