Chapter 6 of
Data Analysis for Experimental Design

Rich Gonzalez

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1   ANOVA

Here is a different way to enter data into R. The previous chapters showed how to read data from existing files. The example also produces the boxplot in Figure 6.2.

```
group <- c(rep(1,8), rep(2,8), rep(3,8), rep(4,8), rep(5,8))
data <- c(16, 18, 5, 12, 11, 12, 23, 19, 16, 7, 10, 4, 7, 23, 12, 13, 2,
  10, 9, 13, 11, 9, 13, 9, 5, 8, 8, 11, 1, 9, 5, 9, 7, 11, 12, 9, 14, 19, 16, 24)
boxplot(data ~ group, xlab="Exercise groups", ylab="Dependent variable",
  cex.lab=1.5, cex.axis=1.5, boxwex=.25)
```

The following example shows to produce the plot of means with plus/minus one standard error (Figure 6.3). To show further R functions, I define the groups in a vector 1 to 5, define the group means that I computed elsewhere. The data vector is as defined above.

```
groups <- c(1, 2, 3, 4, 5)
groupmeans <- c(14.5, 11.5, 9.5, 7, 14)
#initialize the vector of standard errors
se <- c(0,0,0,0,0)
for (i in 1:5)
    se[i] <- sqrt(var(data[group==i])/8)
plot(groups, groupmeans, xlab="Exercise groups", ylab="Dependent variable",
     cex.lab=1.5, cex.axis=1.5, ylim=c(5,18))
segments(1:5, groupmeans+se, 1:5, groupmeans-se)
```

For computing the analysis of variance we will use the aov() command. It will be convenient to define the group variable as a "factor" first before calling the aov() command.

```
group <- factor(group)
output <- aov(data~group)
summary(output)
```

```
> summary(output)
          Df Sum Sq Mean Sq F value  Pr(>F)
group      4 314.40   78.60  3.2518 0.02277 *
Residuals 35 846.00   24.17
```

2 Weighted Means ANOVA

A slight variant

```
group <- factor(c(rep(1,3),rep(2,5),rep(3,4)))
data <- c(3,6,3,5,4,6,4,6,2,3,4,3)
output <- aov(data~group)
summary(output)
```

```
> summary(output)
          Df Sum Sq Mean Sq F value  Pr(>F)
group      4 314.40   78.60  3.2518 0.02277 *
Residuals 35 846.00   24.17
```