Stat 505 R Exploration

August 27, 2014
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1. What is meant by the term "recycling" in R's arithmetic?

   When R is asked to do arithmetic on vectors of different lengths, it 'recycles' the first elements of the shorter vector until it is the same length as the longer vector.

2. You will soon be starting the first homework. Where on your computer (or in your math dept account) will the files (an R script, plots, explanations) reside? Does your group all agree on this structure? If not decribe the differences.

   I have a folder for Stat505 on my computer. In this folder, I have an individual folder for each homework where I keep all the files for that homework (Rscript, plots, etc).

3. On HW1 you should use the `ifelse` function. Read the help file. Use it and the "remainder after division" function `%%` to convert integers 2 through 13 into "odd" or "even". Show your code and results.

```
x <- c(2:13)
results <- ifelse(x%%2 == 0, "even", "odd")
results
```

```
##  [1] "even" "odd"  "even" "odd"  "even" "odd"  "even" "odd"  "even" "odd"  "even" "odd
```

4. For HW 0.5, you looked at the help on boxplot and made a plot of tooth growth relative to two predictors. Use table to find out how many animals were assigned each supplement at each dosage. Show your code and output table.

```
require(xtable)
dose <- factor(ToothGrowth$dose, levels = c(0.5, 1, 2))
xtable(table(dose, ToothGrowth$supp))
```

	OJ	VC
0.5	10	10
1	10	10
2	10	10

5. Using the ToothGrowth data again, build a linear model to assess the effects of supplement and dosage on growth. Show your code and the summary of the model you fit. Interpret the output. How big are the effects?

```
supp <- factor(ToothGrowth$supp, levels = c("VC", "OJ"))
model0 <- lm(ToothGrowth$len ~ dose * supp)
require(xtable)
xtable(summary(model0))
```

	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	7.9800	1.1484	6.95	0.0000
dose1	8.7900	1.6240	5.41	0.0000
dose2	18.1600	1.6240	11.18	0.0000
suppOJ	5.2500	1.6240	3.23	0.0021
dose1:suppOJ	0.6800	2.2967	0.30	0.7683
dose2:suppOJ	-5.3300	2.2967	-2.32	0.0241

```
dose1 <- factor(ToothGrowth$dose, levels = c(1, 0.5, 2))
model1 <- lm(ToothGrowth$len ~ dose1 * supp)
xtable(summary(model1))
```

	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	16.7700	1.1484	14.60	0.0000
dose10.5	-8.7900	1.6240	-5.41	0.0000
dose12	9.3700	1.6240	5.77	0.0000
suppOJ	5.9300	1.6240	3.65	0.0006
dose10.5:suppOJ	-0.6800	2.2967	-0.30	0.7683
dose12:suppOJ	-6.0100	2.2967	-2.62	0.0115

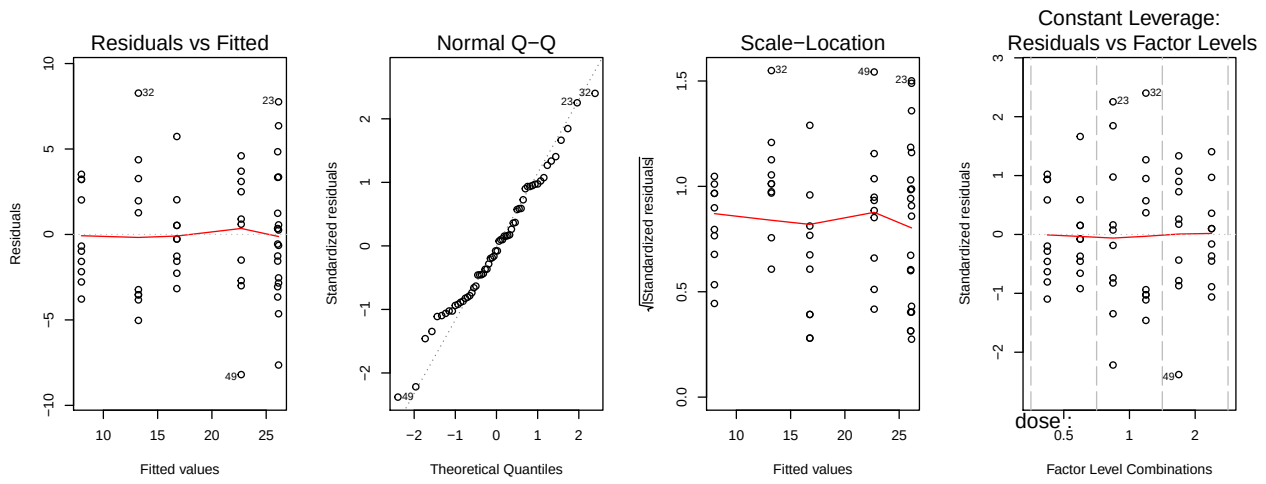
```
dose2 <- factor(ToothGrowth$dose, levels = c(2, 0.5, 1))
model2 <- lm(ToothGrowth$len ~ dose2 * supp)
xtable(summary(model2))
```

There is strong evidence of a difference in tooth lengths between supplements at the lowest vitamin C dose of 0.5 *mg (p-value=*0.0021 *from two-sample t-stat=*3.23 *on* 54 *df. The tooth lengths of guinea pigs receiving the orange juice supplement are estimated to be* 5.25 *units longer than the tooth lengths of pigs receiving the ascorbic acid supplement at a vitamin C dose of* 0.5 *mg with a* 95% *confidence interval from* 1.99 *to* 8.51 *units longer. There is also strong evidence of a difference in tooth length between supplements at the middle vitamin C dose of* 1 *mg (p-value=*0.00059 *from two-sample t-stat=*3.651 *on* 54 *df). There is no evidence of a difference in tooth lengths between supplements at the highest vitamin C dose of* 2 *mg (p-value=*0.9609 *from two-sample t-stat=*−0.049 *on* 54 *df).*

	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	26.1400	1.1484	22.76	0.0000
dose20.5	-18.1600	1.6240	-11.18	0.0000
dose21	-9.3700	1.6240	-5.77	0.0000
suppOJ	-0.0800	1.6240	-0.05	0.9609
dose20.5:suppOJ	5.3300	2.2967	2.32	0.0241
dose21:suppOJ	6.0100	2.2967	2.62	0.0115

6. Show the "usual" four diagnostic plots for the above linear model. Are any problems evident? Save the plot as a png and as a pdf file in the folder from (or parallel to #2 above). What are the dimensions of each of the images?

```
## plot diagnostics for a linear model
par(mfrow = c(1, 4))
plot(model0)
```



I do not see any serious problems with the diagnostics. We set the images to have width 10 and height 4. Since there are four plots, each plot has width 2.5 and height 4. What are the units on these dimensions?

7. The math department server is backed up regularly so that we shouldn't all lose our saved documents. When did you last back up your personal computer? Have you used outside storage like google, dropbox, github, or other? Explain with regard to how you will keep your work safe for this class. In particular, if you are using more than one computer, how will you transfer an partially completed HW back and forth?

I regularly back up my important documents in the Google drive and in the storage space at Amazon. I usually use my laptop, but occasionally I transfer assignments to the school computers via email.

8. To compile this file, be sure you have downloaded the package **knitr** and have LaTeX installed and running. Then there should be an icon just under the tab for this file which says Compile PDF. Click that and watch for any errors.

R Code Appendix

```
x <- c(2:13)
results <- ifelse(x%%2 == 0, "even", "odd")
results
```

```
require(xtable)
dose <- factor(ToothGrowth$dose, levels = c(0.5, 1, 2))
xtable(table(dose, ToothGrowth$supp))
```

```
supp <- factor(ToothGrowth$supp, levels = c("VC", "OJ"))
model0 <- lm(ToothGrowth$len ~ dose * supp)
require(xtable)
xtable(summary(model0))

## % latex table generated in R 2.14.1 by xtable 1.7-1 package
## % Wed Aug 27 15:30:11 2014
## \begin{table}[ht]
## \centering
## \begin{tabular}{rrrrr}
##   \hline
##  & Estimate & Std. Error & t value & Pr($>$$|$t$|$) \\
##   \hline
## (Intercept) & 7.9800 & 1.1484 & 6.95 & 0.0000 \\
##   dose1 & 8.7900 & 1.6240 & 5.41 & 0.0000 \\
##   dose2 & 18.1600 & 1.6240 & 11.18 & 0.0000 \\
##   suppOJ & 5.2500 & 1.6240 & 3.23 & 0.0021 \\
##   dose1:suppOJ & 0.6800 & 2.2967 & 0.30 & 0.7683 \\
##   dose2:suppOJ & -5.3300 & 2.2967 & -2.32 & 0.0241 \\
##    \hline
## \end{tabular}
## \end{table}


dose1 <- factor(ToothGrowth$dose, levels = c(1, 0.5, 2))
model1 <- lm(ToothGrowth$len ~ dose1 * supp)
xtable(summary(model1))
```

```
## % latex table generated in R 2.14.1 by xtable 1.7-1 package
## % Wed Aug 27 15:30:11 2014
## \begin{table}[ht]
## \centering
## \begin{tabular}{rrrrr}
##   \hline
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##   \hline
## (Intercept) & 16.7700 & 1.1484 & 14.60 & 0.0000 \\
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##   suppOJ & 5.9300 & 1.6240 & 3.65 & 0.0006 \\
##   dose10.5:suppOJ & -0.6800 & 2.2967 & -0.30 & 0.7683 \\
##   dose12:suppOJ & -6.0100 & 2.2967 & -2.62 & 0.0115 \\
##    \hline
## \end{tabular}
## \end{table}


dose2 <- factor(ToothGrowth$dose, levels = c(2, 0.5, 1))
model2 <- lm(ToothGrowth$len ~ dose2 * supp)
xtable(summary(model2))

## % latex table generated in R 2.14.1 by xtable 1.7-1 package
## % Wed Aug 27 15:30:11 2014
## \begin{table}[ht]
## \centering
## \begin{tabular}{rrrrr}
##   \hline
##  & Estimate & Std. Error & t value & Pr($>$$|$t$|$) \\
##   \hline
## (Intercept) & 26.1400 & 1.1484 & 22.76 & 0.0000 \\
##   dose20.5 & -18.1600 & 1.6240 & -11.18 & 0.0000 \\
##   dose21 & -9.3700 & 1.6240 & -5.77 & 0.0000 \\
##   suppOJ & -0.0800 & 1.6240 & -0.05 & 0.9609 \\
##   dose20.5:suppOJ & 5.3300 & 2.2967 & 2.32 & 0.0241 \\
##   dose21:suppOJ & 6.0100 & 2.2967 & 2.62 & 0.0115 \\
##    \hline
## \end{tabular}
## \end{table}
```