HW3_Porter_Erica

Erica Porter

9/13/2017

Problem 3

Takeaways from the style guides include:

- Consistency is important; it is best to develop a sufficiently neat programming style and use a similar format throughout multiple files/projects.
- Spacing is essential for writing and reading code; be wary of using tabs.
- Identifiers and variable names should not have excessive special characters and should follow neat, standard naming conventions
- Try to neatly indent code/functions/processes with different types of commands (e.g. when using tidyr, each "verb" should be on its own line).

I will try to improve my own code by:

- Weave my code and text a more effectively for R Markdown documents requiring code, text, and explanations.
- Format, label tables and printed results better (e.g. explore grid functions, stargazer, graph packages).
- Keeping track of variable and data frame names better.
- Including effective spacing and code chunks to improve the appearance and progression of .Rmd files, rather than solely creating a neat PDF.

Problem 4

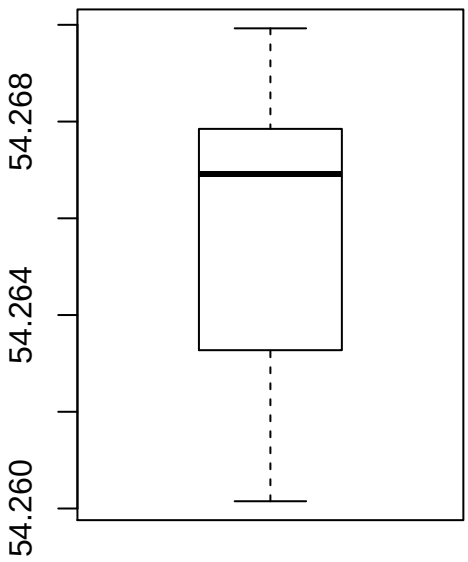
Some suggestions for stylistic improvements included:

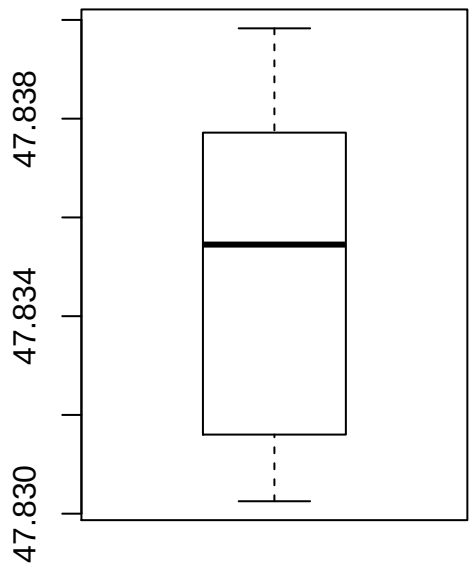
- Inserting spaces after commas and around operators
- Format functions better (e.g. opening and closing curly braces on their own line)
- Limit lines to <80 characters
- Use <- for assignment rather than =
- Consistently use double-quotes rather than single-quotes
- Avoid using absolute paths if possible
- Variable and function names should be lowercase
- Avoid using absolute paths

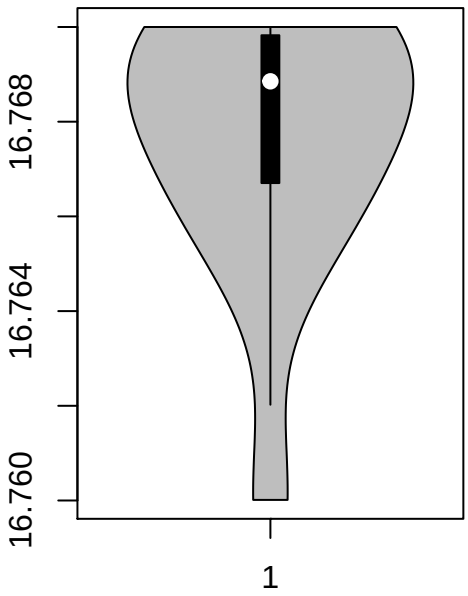
Problem 5

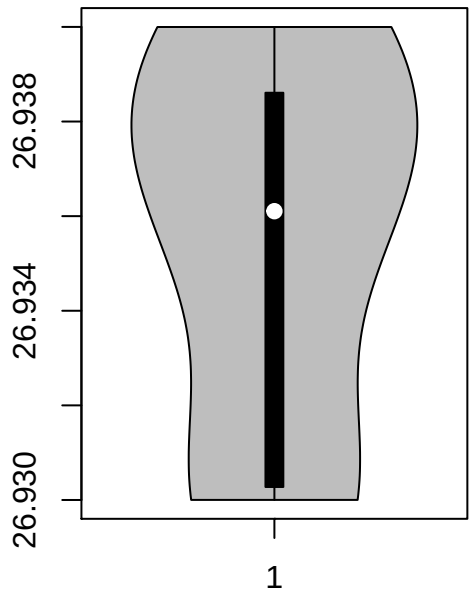
Table 1: Compare dev means

mean1	mean2	sd1	sd2	corr
54.26610	47.83472	16.76983	26.93974	-0.0641284
54.26873	47.83082	16.76924	26.93573	-0.0685864
54.26732	47.83772	16.76001	26.93004	-0.0683434
54.26327	47.83225	16.76514	26.93540	-0.0644719
54.26030	47.83983	16.76774	26.93019	-0.0603414
54.26144	47.83025	16.76590	26.93988	-0.0617148
54.26881	47.83545	16.76670	26.94000	-0.0685042
54.26785	47.83590	16.76676	26.93610	-0.0689797
54.26588	47.83150	16.76885	26.93861	-0.0686092
54.26734	47.83955	16.76896	26.93027	-0.0629611
54.26993	47.83699	16.76996	26.93768	-0.0694456
54.26692	47.83160	16.77000	26.93790	-0.0665752
54.26015	47.83972	16.76996	26.93000	-0.0655833


54.260
54.264
54.268


47.830
47.834
47.838


16.760
16.764
16.768
1


26.930
26.934
26.938
1

Problem 6

The Blood Pressure data from Wu and Humada needs to be reformatted/tidied because the measurements for blood pressure span six different columns, the devices measurements are not grouped together, and doctor measurements are not all grouped together. I will use the `gather`, `separate`, and `mutate` commands in `tidyr` to create a single column for day (the original data has an extraneous column for day) and columns for measuring entity, associated measure number, and the measurement value. Below I have printed the first 5 rows of the tidy data set and a summary table describing the data. See the Appendix for full R code.

Table 2: First 5 observations for Blood Pressure

Day	method	replicate	value
1	Dev	1	133.34
2	Dev	1	110.94
3	Dev	1	118.54
4	Dev	1	137.94
5	Dev	1	139.52

Table 3: Summary of Blood Pressure data

Day	method	replicate	value
Length:90	Length:90	Length:90	Min. :110.8
Class :character	Class :character	Class :character	1st Qu.:125.5
Mode :character	Mode :character	Mode :character	Median :130.4
NA	NA	NA	Mean :129.0
NA	NA	NA	3rd Qu.:134.3
NA	NA	NA	Max. :139.6

Problem 7

```
## $solution
## [1] -9.162986
##
## $`number iterations`
## [1] -9.109611 -9.162556 -9.162986 -9.162986
```

```
##
Read 43.9% of 1048575 rows
Read 1048575 rows and 13 (of 13) columns from 0.093 GB file in 00:00:03
```

Table 4: Number of Unique Makes and Models

unique_make	unique_model
38	405

Table 5: Top Defects, their makes, and models

top_defects	top_defect_makes	top_defect_models
K04	VOLKSWAGEN	GOLF PLUS
AC1	VOLKSWAGEN	FOX
G05	PEUGEOT	307; SW 2.0HDI 66KW
K05	VOLKSWAGEN	GOLF
J03	OPEL	AGILA; Z1.2XE

Table 6: Description of linear fit by Make

	Dependent variable:
	n
Make	0.593** (0.282)
Constant	4.788 (6.301)
Observations	38
R^2	0.109
Adjusted R^2	0.085
Residual Std. Error	19.040 (df = 36)
F Statistic	4.425** (df = 1; 36)
Note:	*p<0.1; **p<0.05; ***p<0.01

Table 7: ANOVA of linear fit by Make

Statistic	N	Mean	St. Dev.	Min	Max
Df	2	18.500	24.749	1	36
Sum Sq	2	7,327.276	8,093.601	1,604.236	13,050.320
Mean Sq	2	983.372	878.034	362.509	1,604.236
F value	1	4.425		4.425	4.425
Pr(>F)	1	0.042		0.042	0.042

Table 8: Description of linear fit by Model

	Dependent variable:
	n
Model	0.0001 (0.001)
Constant	1.518*** (0.121)
Observations	405
R^2	0.0001
Adjusted R^2	−0.002
Residual Std. Error	1.213 (df = 403)
F Statistic	0.022 (df = 1; 403)
Note:	*p<0.1; **p<0.05; ***p<0.01

There appears to be a relationship between car make and number of defects.

Table 9: ANOVA of linear fit by Model

Statistic	N	Mean	St. Dev.	Min	Max
Df	2	202.000	284.257	1	403
Sum Sq	2	296.400	419.126	0.033	592.767
Mean Sq	2	0.752	1.017	0.033	1.471
F value	1	0.022		0.022	0.022
Pr(>F)	1	0.881		0.881	0.881

This workflow could certainly be improved; I had trouble finding the most common makes and models for each defects, so I ended up creating many separate data sets and using `subset` and `count` multiple times. This does not seem very efficient to me and I would have liked to use the `subset` and `count` functions to make the table of common values in one step (or at least fewer).

Appendix: R code

```
## Problem 4 ##
## Get stylistic comments about homework 2 ##

lint(filename = ("02_data_munging_summarizing_R_git/HW2_Porter_Erica.Rmd")
```

```
## Problem 5 ## Write a function to determine summary
## statistics for device measurements ##

dev_data <- readRDS("./HW3_data.rds")

# Initialize empty vectors to receive each of the stats for
# the observations #
mean1 <- c()
mean2 <- c()
sd1 <- c()
sd2 <- c()
corr <- c()

# Loop through the data to evaluate mean, sd, and correlation
# for each of 13 observers #
for (i in 1:13) {
    mean1[i] <- mean(subset(dev_data, Observer == i)$dev1)
    mean2[i] <- mean(subset(dev_data, Observer == i)$dev2)
    sd1[i] <- sd(subset(dev_data, Observer == i)$dev1)
    sd2[i] <- sd(subset(dev_data, Observer == i)$dev2)
    corr[i] <- cor(subset(dev_data, Observer == i)$dev1, subset(dev_data,
        Observer == i)$dev2)
}

summary_stats <- cbind(mean1, mean2, sd1, sd2, corr)
summary_stats <- as.data.frame(summary_stats)
```

```
## Problem 5 ## Paste the summary statistics into a data frame
## to print ##
knitr::kable(summary_stats, caption = "Compare dev means")
```

```
## Problem 5 ## Create boxplots to compare dev1 and dev2 means
## ##
par(mfrow = c(1, 2))
boxplot(mean1, data = summary_stats)
boxplot(mean2, data = summary_stats)
vioplot(summary_stats$sd1, col = "gray")
vioplot(summary_stats$sd2, col = "gray")
```

```
## Problem 6 ## Tidy the Blood Pressure data set ##
url <- "http://www2.isye.gatech.edu/~jeffwu/wuhamadabook/data/BloodPressure.dat"
blood_pressure <- read.table(url, header = F, skip = 1, fill = T,
    stringsAsFactors = F)
```

```r
blood_pressure_tidy <- blood_pressure[-1, -5]
colnames(blood_pressure_tidy) <- c("Day", "Dev_1", "Dev_2", "Dev_3",
    "Doc_1", "Doc_2", "Doc_3")
blood_pressure_tidy <- blood_pressure_tidy %>% gather(measure_num,
    value, Dev_1:Doc_3) %>% separate(measure_num, into = c("method",
    "replicate"), sep = "_") %>% mutate(value = as.numeric(value))

# Print first 5 observations and a summary table
knitr::kable(head(blood_pressure_tidy, n = 5), caption = "First 5 observations for Blood Pressure")
knitr::kable(summary(blood_pressure_tidy), caption = "Summary of Blood Pressure data")
```

```r
## Another method I tried for tidying Blood Pressure Data that
## I wanted to keep for reference ##
url <- "http://www2.isye.gatech.edu/~jeffwu/wuhamadabook/data/BloodPressure.dat"
blood_pressure <- read.table(url, header = F, skip = 1, fill = T,
    stringsAsFactors = F)
blood_pressure_tidy <- blood_pressure[-1, ]
colnames(blood_pressure_tidy) <- c("Day_1", "Dev_1", "Dev_2",
    "Dev_3", "Day_2", "Doc_1", "Doc_2", "Doc_3")
devices <- blood_pressure_tidy[, c("Dev_1", "Dev_2", "Dev_3")]
doctors <- blood_pressure_tidy[, c("Doc_1", "Doc_2", "Doc_3")]
devices <- devices %>% gather(Device, device_read, Dev_1:Dev_3) %>%
    mutate(Device = gsub("Dev_", "", Device))
doctors <- doctors %>% gather(Doctor, doc_read, Doc_1:Doc_3) %>%
    mutate(Doctor = gsub("Doc_", "", Doctor))
Day <- rep(1:15, 3)
blood_pressure_tidy <- cbind(Day, devices, doctors)
blood_presure_tidy <- as.numeric(c(blood_pressure_tidy$device_read,
    blood_pressure_tidy$doc_read))
```

```r
## Problem 7 ##

# This is my first attempt at a function for Newton's method
# # This generates a solution without displaying intermediate
# iterations # Begin with a starting value for x Obtain an
# estimate x - f(x)/f'(x) Repeat while the tolerance
# conditions are satisfied

fun <- function(x) {
    3^x - sin(x) + cos(5 * x)
}
der <- function(x) {
    log(3) * 3^x - 5 * sin(5 * x) - cos(x)
}
newton <- function(fun, der, a, t = 0.01) {
    b <- a - fun(a)/der(a)
    while ((abs(a - b) > t) & (abs(a - b)/(abs(a) + abs(b))) >
        t) {
        c <- a - fun(a)/der(a)
        b <- a
        a <- c
        result <- a
```

```
        return(result)
    }
}
```

```
## Problem 7 ## This is my second attempt at Newton's method
## with iterations #

fun <- function(x) {
    3^x - sin(x) + cos(5 * x)
}
der <- function(x) {
    log(3) * 3^x - 5 * sin(5 * x) - cos(x)
}

newton2 <- function(f, a, b, t, n = 1000) {
    x_0 <- a
    k <- n
    for (i in 1:n) {
        deriv <- der(x_0)
        c <- x_0 - (fun(x_0)/deriv)
        k[i] <- c
        if (abs(c - x_0) < t) {
            estimate <- tail(k, n = 1)
            to_print <- list(solution = estimate, `number iterations` = k)
            return(to_print)

        }
        x_0 <- c
    }
}

newton2(fun, -10, 10, 1e-04, n = 100)
```

```
## Problem 8 ## Merge and analyze car data ##

# Read in data using fread since files are large
Car_Geb <- fread(input = "Open_Data_RDW__Gebreken.csv", header = T)  #dat2
Car_Gec <- fread(input = "Open_Data_RDW__Geconstateerde_Gebreken.csv",
    header = T)  #dat3
Car_Person <- fread(input = "Personenauto_basisdata.csv", header = T)  #dat1

# Merge the 3 data sets be common columns
plates <- merge(Car_Person, Car_Gec, by = "Kenteken")
defects <- merge(plates, Car_Geb, by = "Gebrek identificatie")

# Select only columns of interest, rename columns in English
defects_small <- defects[, c(1, 2, 4, 5, 16, 24)]
colnames(defects_small) <- c("Defect Code", "License", "Make",
    "Model", "Inspection Date", "Defect Description")

# Check for NA values in the data set we will be working with
check_na <- sum(is.na(defects_small$`Defect Code`))
```

```r
# Subset all rows from year 2017 and count unique Makes and
# Models
defects17 <- defects_small[grep("2017", defects_small$`Inspection Date`),
    ]
unique_make <- length(unique(defects17$Make))
unique_model <- length(unique(defects17$Model))
knitr::kable(as.data.frame(cbind(unique_make, unique_model)),
    caption = "Number of Unique Makes and Models")

# Find top 5 defect codes
common_defects <- as.data.frame(defects17 %>% count(`Defect Code`,
    sort = TRUE))
top_defects <- common_defects$`Defect Code`[1:5]

# Find most common make for each of above defects
defect_make1 <- (as.data.frame(subset(defects17, `Defect Code` ==
    top_defects[1]) %>% count(Make, sort = TRUE)))[1, 1]
defect_make2 <- (as.data.frame(subset(defects17, `Defect Code` ==
    top_defects[2]) %>% count(Make, sort = TRUE)))[1, 1]
defect_make3 <- (as.data.frame(subset(defects17, `Defect Code` ==
    top_defects[3]) %>% count(Make, sort = TRUE)))[1, 1]
defect_make4 <- (as.data.frame(subset(defects17, `Defect Code` ==
    top_defects[4]) %>% count(Make, sort = TRUE)))[1, 1]
defect_make5 <- (as.data.frame(subset(defects17, `Defect Code` ==
    top_defects[5]) %>% count(Make, sort = TRUE)))[1, 1]
top_defect_makes <- c(defect_make1, defect_make2, defect_make3,
    defect_make4, defect_make5)

# Find most common model for each of above makes
def1 <- subset(defects17, `Defect Code` == top_defects[1] & Make ==
    top_defect_makes[1])
def2 <- subset(defects17, `Defect Code` == top_defects[2] & Make ==
    top_defect_makes[2])
def3 <- subset(defects17, `Defect Code` == top_defects[3] & Make ==
    top_defect_makes[3])
def4 <- subset(defects17, `Defect Code` == top_defects[4] & Make ==
    top_defect_makes[4])
def5 <- subset(defects17, `Defect Code` == top_defects[5] & Make ==
    top_defect_makes[5])

defect_model1 <- (as.data.frame(def1 %>% count(Model, sort = TRUE)))[1,
    1]
defect_model2 <- (as.data.frame(def2 %>% count(Model, sort = TRUE)))[1,
    1]
defect_model3 <- (as.data.frame(def3 %>% count(Model, sort = TRUE)))[1,
    1]
defect_model4 <- (as.data.frame(def4 %>% count(Model, sort = TRUE)))[1,
    1]
defect_model5 <- (as.data.frame(def5 %>% count(Model, sort = TRUE)))[1,
    1]
top_defect_models <- c(defect_model1, defect_model2, defect_model3,
    defect_model4, defect_model5)
```

```r
# Table of common defect codes, their makes, and models
defect_table <- as.data.frame(cbind(top_defects, top_defect_makes,
    top_defect_models))
knitr::kable(defect_table, caption = "Top Defects, their makes, and models")

# Check for relationship b/w number of defects and make, then
# by model
carmake <- as.data.frame(defects17 %>% count(Make, sort = TRUE))
carmake$Make <- as.numeric(factor(carmake$Make))
colnames(carmake) <- c("Make", "n")
carmodel <- as.data.frame(defects17 %>% count(Model, sort = TRUE))
carmodel$Model <- as.numeric(factor(carmodel$Model))
```

```r
## Problem 8 ##
fit = lm(n ~ Make, data = carmake)
stargazer(fit, title = "Description of linear fit by Make", header = F,
    no.space = T, single.row = T)
stargazer(anova(fit), title = "ANOVA of linear fit by Make",
    header = F, no.space = T, single.row = T)


fit1 = lm(n ~ Model, data = carmodel)
stargazer(fit1, title = "Description of linear fit by Model",
    header = F, no.space = T, single.row = T)
stargazer(anova(fit1), title = "ANOVA of linear fit by Model",
    header = F, no.space = T, single.row = T)
```