Data Wrangling in R

Jerry Xin STA 360: Homework 1

Due Friday August 27, 5 PM EDT

Today's agenda: Manipulating data objects; using the built-in functions, doing numerical calculations, and basic plots; reinforcing core probabilistic ideas.

General instructions for homeworks: Please follow the uploading file instructions according to the syllabus. You will give the commands to answer each question in its own code block, which will also produce plots that will be automatically embedded in the output file. Each answer must be supported by written statements as well as any code used. Your code must be completely reproducible and must compile.

Advice: Start early on the homeworks and it is advised that you not wait until the day of. While the professor and the TA's check emails, they will be answered in the order they are received and last minute help will not be given unless we happen to be free.

Commenting code Code should be commented. See the Google style guide for questions regarding commenting or how to write code https://google.github.io/styleguide/Rguide.xml. No late homework's will be accepted.

R Markdown Test

0. Open a new R Markdown file; set the output to HTML mode and "Knit". This should produce a web page with the knitting procedure executing your code blocks. You can edit this new file to produce your homework submission.

Working with data

Total points on assignment: 10 (reproducibility) + 22 (Q1) + 9 (Q2) + 3 (Q3) = 44 points

Reproducibility component: 10 points.

```r
library(tidyverse)
library(knitr)
library(broom)
```

1. (22 points total, equally weighted) The data set **rnf6080.dat** records hourly rainfall at a certain location in Canada, every day from 1960 to 1980.

a. Load the data set into R and make it a data frame called `rain.df`. What command did you use?

```r
rain.df <- read.table("data/rnf6080.dat")
```

b. How many rows and columns does `rain.df` have? How do you know? (If there are not 5070 rows and 27 columns, you did something wrong in the first part of the problem.)

```r
dim(rain.df)[1]
```

```
## [1] 5070
```

```r
dim(rain.df)[2]
```

```
## [1] 27
```

rain.df has 5070 rows and 27 columns, because it has 5070 observations of 27 variables. The 5070 observations of 27 variables is shown in the environment tab , and dim(rain.df)[1] gets the amount of rows and dim(rain.df)[2] gets number of columns

c. What command would you use to get the names of the columns of `rain.df`? What are those names?

```
colnames(rain.df)
```

```
##  [1] "V1"  "V2"  "V3"  "V4"  "V5"  "V6"  "V7"  "V8"  "V9"  "V10" "V11" "V12"
## [13] "V13" "V14" "V15" "V16" "V17" "V18" "V19" "V20" "V21" "V22" "V23" "V24"
## [25] "V25" "V26" "V27"
```

Use the command colnames(), to get the names of the columns. The names of the columns are: "V1" "V2" "V3" "V4" "V5" "V6" "V7" "V8" "V9" "V10" "V11" "V12" "V13" "V14" "V15" "V16" "V17" "V18" "V19" "V20" "V21" "V22" "V23" "V24" "V25" "V26" "V27".

d. What command would you use to get the value at row 2, column 4? What is the value?

```
view(rain.df[2,"V4"])
```

Use view(rain.df[2,"V4"]). The value is 0

e. What command would you use to display the whole second row? What is the content of that row?

```
view(rain.df[2, ])
```

Use view(rain.df[2,]). The content of that row is: 60 4 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0

f. What does the following command do?

```
names(rain.df) <- c("year","month","day",seq(0,23))
```

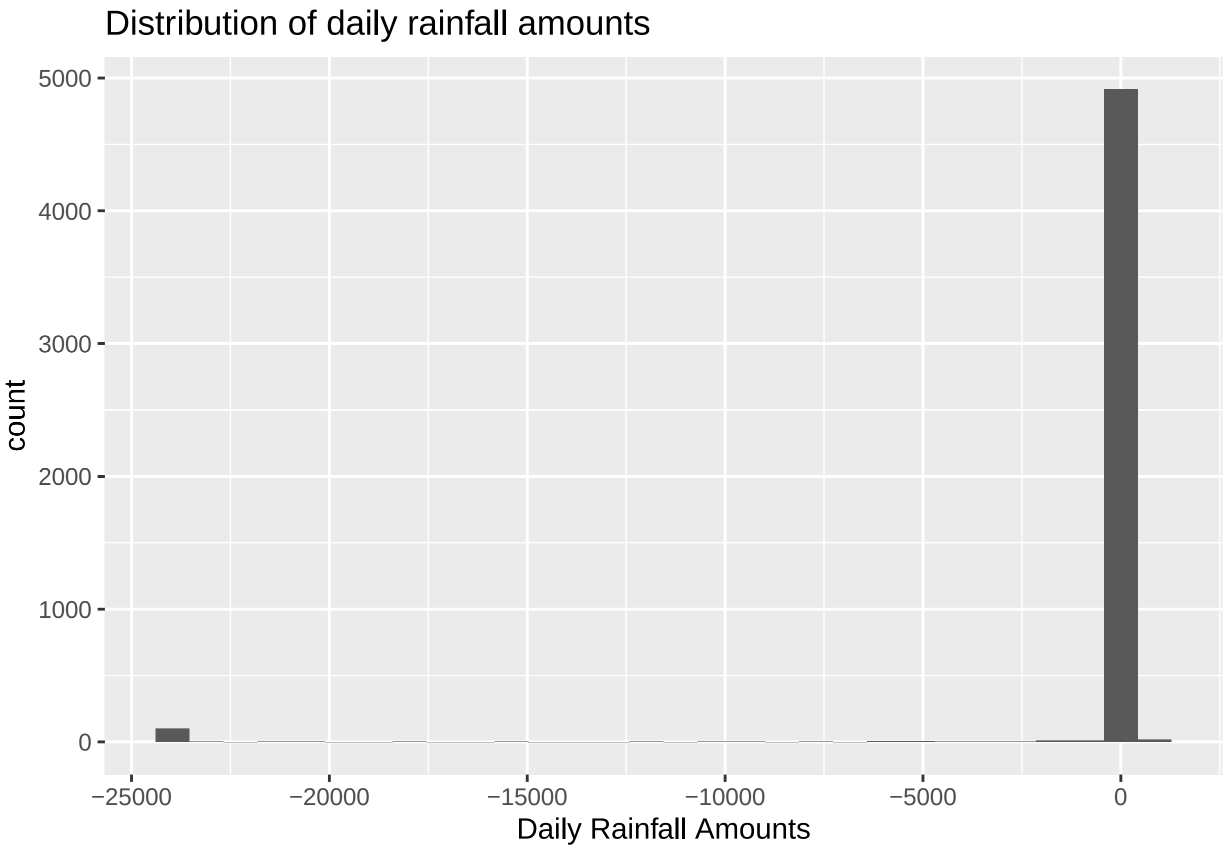
The command relabels the first 3 columns to year, month, day, and then the last 24 columns of the hours from 0-23, because rainfall is collected hourly.

g. Create a new column called `daily`, which is the sum of the 24 hourly columns.

```
rain.df <- rain.df%>%
  mutate(daily = rowSums(.[4:27]))
```

h. Give the command you would use to create a histogram of the daily rainfall amounts. Please make sure to attach your figures in your .pdf report.

```
ggplot(data = rain.df, aes(x = daily)) +
  geom_histogram() +
  labs(x = "Daily Rainfall Amounts",
       title = "Distribution of daily rainfall amounts")
```



i. Explain why that histogram above cannot possibly be right.

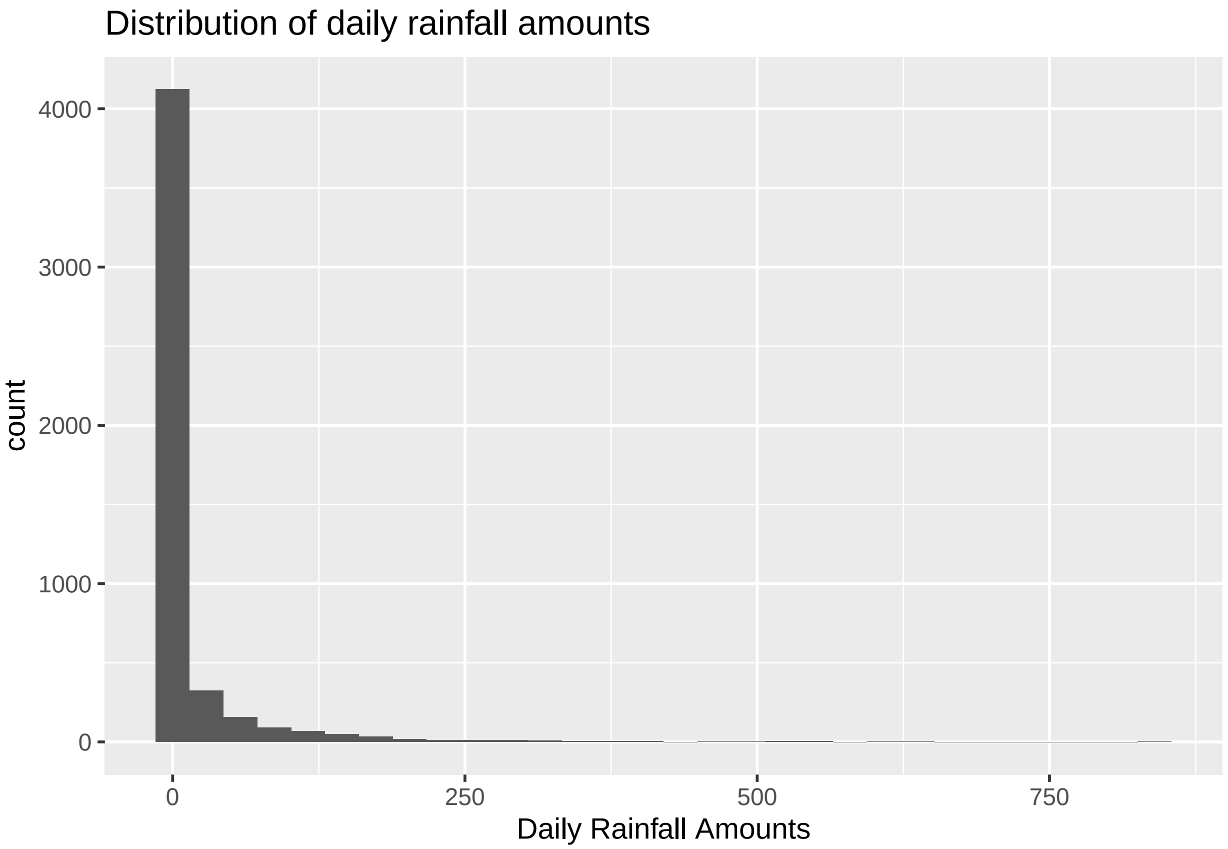
It cannot possibly be right because there seems to be 1 daily rainfall amount that is around -24000. It doesn't make sense for rain to fall at a negative amount.

j. Give the command you would use to fix the data frame.

```
rain.df <- rain.df%>%
  filter(daily >= 0)
```

k. Create a corrected histogram and again include it as part of your submitted report. Explain why it is more reasonable than the previous histogram.

```
ggplot(data = rain.df, aes(x = daily)) +
  geom_histogram() +
  labs(x = "Daily Rainfall Amounts",
       title = "Distribution of daily rainfall amounts")
```



This is more reasonable because the lowest amount of daily rainfall is reasonably set at 0(on days which it doesn't rain). The histogram also doesn't have any extreme outliers.

Data types

2. (9 points, equally weighted) Make sure your answers to different parts of this problem are compatible with each other.

a. For each of the following commands, either explain why they should be errors, or explain the non-erroneous result.

```
x <- c("5","12","7")
max(x)
sort(x)
sum(x)
```

x is assigned a vector that is 3 in length and contains the strings "5", "12", and "7" max(x) results in "7" because we are looking at the strings "5", "7", and "12" , and we look only at the first character of the string and use the lexiographic order, where 7 is the largest lexiographically and is therefore the max.

sort(x) sorts the list of strings based on the first character of the string, which we look only at the first character of the string and use the lexiographic order, where the order from least to greatest is "12","5", "7".

sum(x) is trying to find the sum of the vector, however there is no method sum to find the sum of a character vector, the values are not integers but rather characters so it returns an error when trying to sum the strings.

b. For the next two commands, either explain their results, or why they should produce errors.

```
y <- c("5",7,12)
y[2] + y[3]
```

y is assigned an array that is 3 in length and contains the string "5" and the integers 7 and 12. y[2] + y[3] produces an error because our vector is an vector of characters, so every value is therefore treated like a character, which includes 7 and 12. Since y[2] + y[3] is trying to add the characters "7" and "12", a non-numeric argument to binary operator error is made.

c. For the next two commands, either explain their results, or why they should produce errors.

```
z <- data.frame(z1="5",z2=7,z3=12)
z[1,2] + z[1,3]
```

Z is assigned a data frame of "5", 7 and 12, which keeps "5" as a string and 7 and 12 as integers. Z[1,2] gets the value at row 1, column 2, which is 7, and Z[1,3] gets the value at row 1, column 3, which is 12. Adding 7 and 12 gets 19.

3. (3 pts, equally weighted).

a.) What is the point of reproducible code? **Reproducible code adds a degree of reliability to your experiment data, analysis, and conclusions to prove that your results weren't a fluke and statistically are not an outlier or extreme case. Reproducible code allows different scientists to check each other's work and confirm the validity of others' experiment. Reproducible code is an essential part of the scientific method, as experiments must be repeatable.**

b.) Given an example of why making your code reproducible is important for you to know in this class and moving forward.

When publishing PHD research in a peer review journal, if a research study is found to be non-reproducible, then this paper will not be recommended to the journal for publication. Additionally, if the teacher wants to validate a lab result, your code must be able to produce the same result again.

c.) On a scale of 1 (easy) – 10 (hard), how hard was this assignment. If this assignment was hard (> 5), please state in one sentence what you struggled with.

I would give this assignment a 4 in terms of difficulty.