R Practice Answers

Ryan Safner

September 12, 2018

Getting Set Up

Before we begin, start a new file with `File` → `New File` → `R Script`. As you work through this sheet in the console in `R`, also add (copy/paste) your commands that work into this new file. At the end, save it, and run to execute all of your commands at once.

Creating Objects

1. Create a vector called "me" with two objects, your first name, and your last name. Then call the vector to inspect it. Confirm it is a character class vector.

```
me<-c("Ryan","Safner")
me
```

```
## [1] "Ryan"   "Safner"
```

```
class(me)
```

```
## [1] "character"
```

2. Create a vector called "x" with all the even integers from 2 to 10.

```
x<-c(2,4,6,8,10)
```

3. Find the mean of x with `mean()`

```
mean(x)
```

```
## [1] 6
```

4. Now take the following pdf of random variable Y:

y_i	p_i
2	0.50
4	0.25
6	0.25

Calculate the standard deviation "manually" using our table method. You can look at the source code of Lecture 4 for my example.

a. Creating two vectors, one called $y.i$ and one called $p.i$, with the data above.

```
y.i<-c(2,4,6)
p.i<-c(0.5,0.25,0.25)
```

b. Merge them into a data frame called rv with `data.frame(y.i,p.i)`. Call `rv` to inspect it.

```
rv<-data.frame(y.i,p.i)
rv
```

```
##   y.i  p.i
## 1   2 0.50
## 2   4 0.25
## 3   6 0.25
```

c. Find the expected value of Y by taking the sum of each value of `y.i` multiplied by `p.i` with the `sum()` command.

```
sum(rv$y.i*rv$p.i)
```

```
## [1] 3.5
```

d. Creating a new column in `rv` called `deviations`, where you subtract the mean from each `y.i` value. Call `rv` again to make sure it's now there.

```
rv$deviations<-(rv$y.i-3.5)
rv
```

```
##   y.i  p.i deviations
## 1   2 0.50       -1.5
## 2   4 0.25        0.5
## 3   6 0.25        2.5
```

e. Create another column in `rv` called `devsq`, where you square the deviations from part d. Call `rv` again to make sure it's now there.

```
rv$devsq<-(rv$deviations^2)
rv
```

```
##   y.i  p.i deviations devsq
## 1   2 0.50       -1.5  2.25
## 2   4 0.25        0.5  0.25
## 3   6 0.25        2.5  6.25
```

f. Now add another column in `rv` called `weighteddevsq`, where you multiply the squared deviations in part e. by the associated probability `p.i`. Call `rv` again to make sure it's now there.

```
rv$weighteddevsq<-(rv$devsq*rv$p.i)
rv
```

```
##   y.i  p.i deviations devsq weighteddevsq
## 1   2 0.50       -1.5  2.25        1.1250
## 2   4 0.25        0.5  0.25        0.0625
## 3   6 0.25        2.5  6.25        1.5625
```

g. Finally, take the sum of `weighteddevsq` to get variance. Square root this to get standard deviation.

```
sum(rv$weighteddevsq)
```

```
## [1] 2.75
```

```
sqrt(sum(rv$weighteddevsq))
```

```
## [1] 1.658312
```

5. The mean height of adults is 65 inches, with a standard deviation of 4 inches. Use the normal distribution to find the probabilities of the following scenarios:

a. Find the probability of someone being *at least* 60 inches tall using `pnorm()`.

```
pnorm(60, mean=65, sd=4, lower.tail=FALSE)
```

```
## [1] 0.8943502
```

b. Find the probability of someone being *at most* 60 inches tall.

```
pnorm(60, mean=65, sd=4, lower.tail=TRUE)
```

```
## [1] 0.1056498
```

c. Find the probability of someone being between 61 and 69 inches tall. Why is this number familiar?

```
pnorm(69, mean=65, sd=4, lower.tail=TRUE)-pnorm(61, mean=65, sd=4, lower.tail=TRUE)
```

```
## [1] 0.6826895
```

d. Find the probability of someone being between 57 and 73 inches tall. Why is this number familiar?

```
pnorm(73, mean=65, sd=4, lower.tail=TRUE)-pnorm(57, mean=65, sd=4, lower.tail=TRUE)
```

```
## [1] 0.9544997
```

Playing with a Data Set

For the following questions, use the `diamonds` dataset, included as part of `ggplot2`.

1. Install `ggplot2`

```
install.packages("ggplot2")
```

2. Load `ggplot2` with the `library()` command

```
library(ggplot2)
```

3. Get the structure of the diamonds data.frame. What are the different variables and what kind of data does each contain?

```
str(diamonds)
```

```
## Classes 'tbl_df', 'tbl' and 'data.frame':    53940 obs. of  10 variables:
##  $ carat  : num  0.23 0.21 0.23 0.29 0.31 0.24 0.24 0.26 0.22 0.23 ...
##  $ cut    : Ord.factor w/ 5 levels "Fair"<"Good"<..: 5 4 2 4 2 3 3 3 1 3 ...
##  $ color  : Ord.factor w/ 7 levels "D"<"E"<"F"<"G"<..: 2 2 2 6 7 7 6 5 2 5 ...
##  $ clarity: Ord.factor w/ 8 levels "I1"<"SI2"<"SI1"<..: 2 3 5 4 2 6 7 3 4 5 ...
##  $ depth  : num  61.5 59.8 56.9 62.4 63.3 62.8 62.3 61.9 65.1 59.4 ...
##  $ table  : num  55 61 65 58 58 57 57 55 61 61 ...
##  $ price  : int  326 326 327 334 335 336 336 337 337 338 ...
##  $ x      : num  3.95 3.89 4.05 4.2 4.34 3.94 3.95 4.07 3.87 4 ...
##  $ y      : num  3.98 3.84 4.07 4.23 4.35 3.96 3.98 4.11 3.78 4.05 ...
##  $ z      : num  2.43 2.31 2.31 2.63 2.75 2.48 2.47 2.53 2.49 2.39 ...
```

4. Get summary statistics for `carat`, `depth`, `table`, and `price`

```
summary(diamonds$carat)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##  0.2000  0.4000  0.7000  0.7979  1.0400  5.0100
```

```
summary(diamonds$depth)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##   43.00   61.00   61.80   61.75   62.50   79.00
```

```
summary(diamonds$table)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##   43.00   56.00   57.00   57.46   59.00   95.00
```

```
summary(diamonds$price)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##     326     950    2401    3933    5324   18823
```

5. `color`, `cut`, and `clarity` are categorical variables (factors). Use the `table()` command to generate frequency tables for each.

```
table(diamonds$cut)
```

```
##
##      Fair      Good Very Good   Premium     Ideal
##      1610      4906     12082     13791     21551
```

```
table(diamonds$color)
```

```
##
##     D     E     F     G     H     I     J
##  6775  9797  9542 11292  8304  5422  2808
```

```
table(diamonds$clarity)
```

```
##
##    I1   SI2   SI1   VS2   VS1  VVS2  VVS1    IF
##   741  9194 13065 12258  8171  5066  3655  1790
```

Note, you can also use `summary()` to get the counts of each category.

6. Now rerun the `summary()` command on the entire data frame

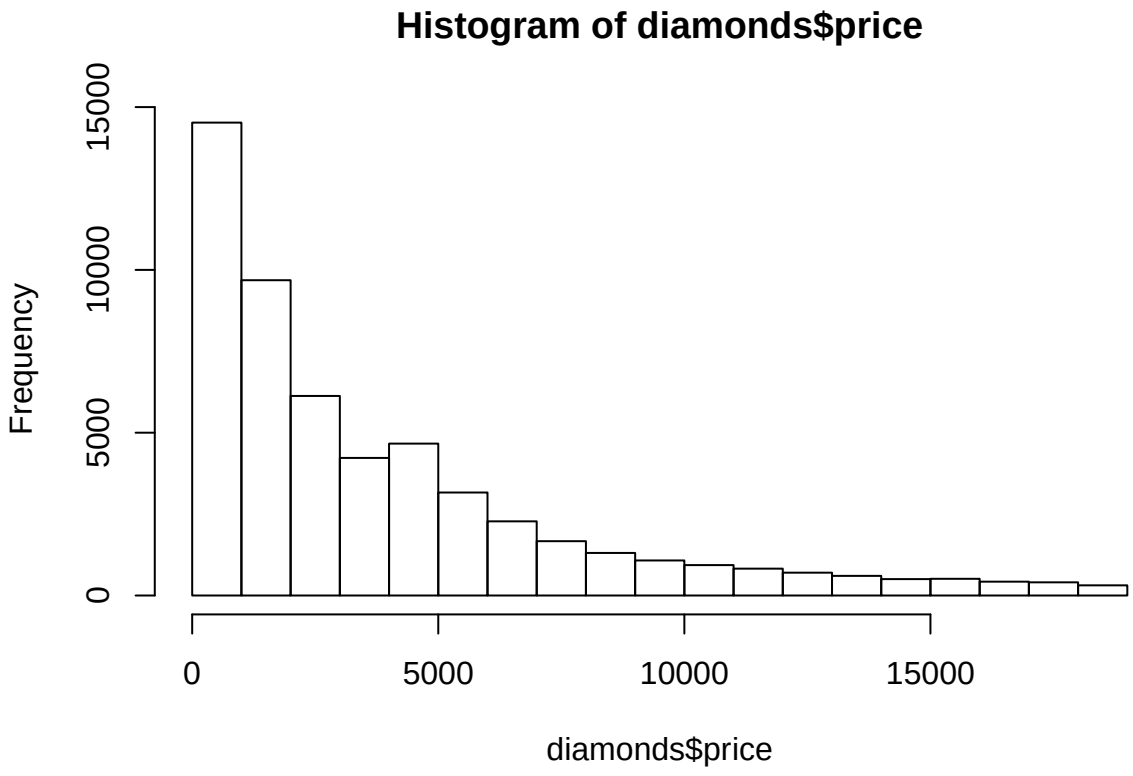
```
summary(diamonds)
```

```
##      carat               cut        color        clarity
##  Min.   :0.2000   Fair      : 1610   D: 6775   SI1    :13065
##  1st Qu.:0.4000   Good      : 4906   E: 9797   VS2    :12258
##  Median :0.7000   Very Good:12082   F: 9542   SI2    : 9194
##  Mean   :0.7979   Premium   :13791   G:11292   VS1    : 8171
##  3rd Qu.:1.0400   Ideal     :21551   H: 8304   VVS2   : 5066
##  Max.   :5.0100                     I: 5422   VVS1   : 3655
```

```
##                                    J: 2808   (Other): 2531
##      depth           table           price             x
##  Min.   :43.00   Min.   :43.00   Min.   :  326   Min.   : 0.000
##  1st Qu.:61.00   1st Qu.:56.00   1st Qu.:  950   1st Qu.: 4.710
##  Median :61.80   Median :57.00   Median : 2401   Median : 5.700
##  Mean   :61.75   Mean   :57.46   Mean   : 3933   Mean   : 5.731
##  3rd Qu.:62.50   3rd Qu.:59.00   3rd Qu.: 5324   3rd Qu.: 6.540
##  Max.   :79.00   Max.   :95.00   Max.   :18823   Max.   :10.740
##
##        y               z
##  Min.   : 0.000   Min.   : 0.000
##  1st Qu.: 4.720   1st Qu.: 2.910
##  Median : 5.710   Median : 3.530
##  Mean   : 5.735   Mean   : 3.539
##  3rd Qu.: 6.540   3rd Qu.: 4.040
##  Max.   :58.900   Max.   :31.800
##
```

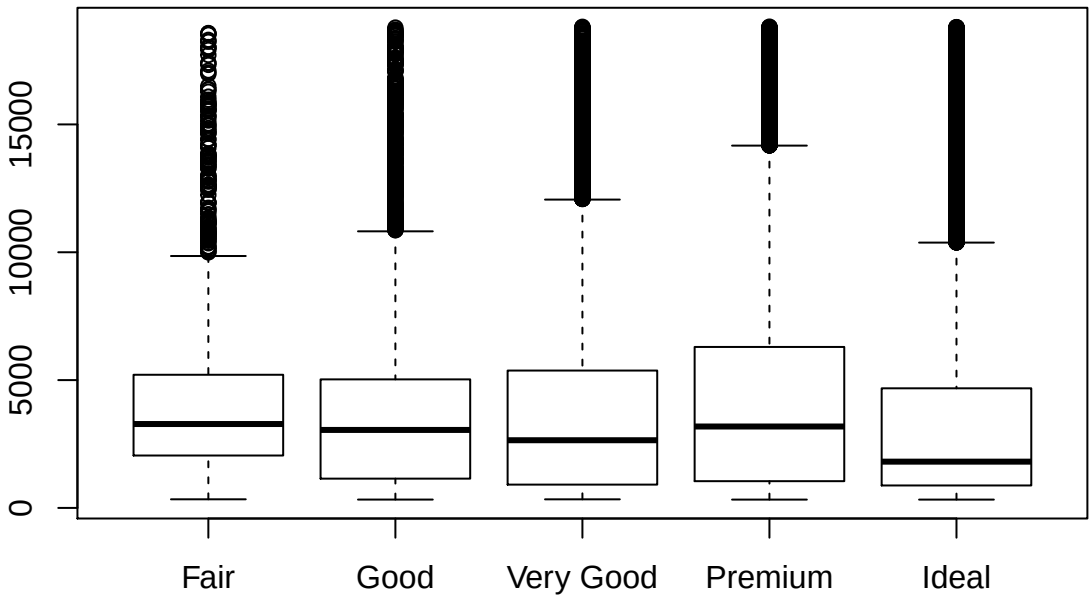
7. Plot a histogram of price.

```
hist(diamonds$price)
```



8. Plot a boxplot of price by diamond color.

```
boxplot(price~cut,data=diamonds)
```



Execute your R Script

Save the R Script you created at the beginning and (hopefully) have been pasting all of your valid commands to. This creates a *.R* file wherever you choose to save it to. Now looking at the file in the upper left pane of *R Studio* look for the button in the upper right corner that says **Run**. Sit back and watch `R` redo everything you've carefully worked on, all at once.