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Homework 2

Homework Instructions

For questions that require code, please create a code chunk directly below the question and type your code there. Your knitted pdf will show both your code and your output. You are encouraged to knit your file as you work to check that your coding and formatting is done so appropriately.

For written responses or multiple choice questions, please bold your (selected) answer.

Grading Details

All questions will be graded full credit (1 point), half credit (0.5 point) or no credit (0 points).

Full credit responses should have the correct response and appropriate code (if applicable). Half credit responses will have a reasonable attempt (typically no more than one small error or oversight), and no credit responses will be either non-attempts or attempts with significant errors.

Exercise 1

General Note For each dataset we explore, you might want to View the data using View(data_name) in the starter code. However if you can, delete these codes (or place # in front) before knitting your pdf for submission to avoid unnecessary clutter in your final report when grading.

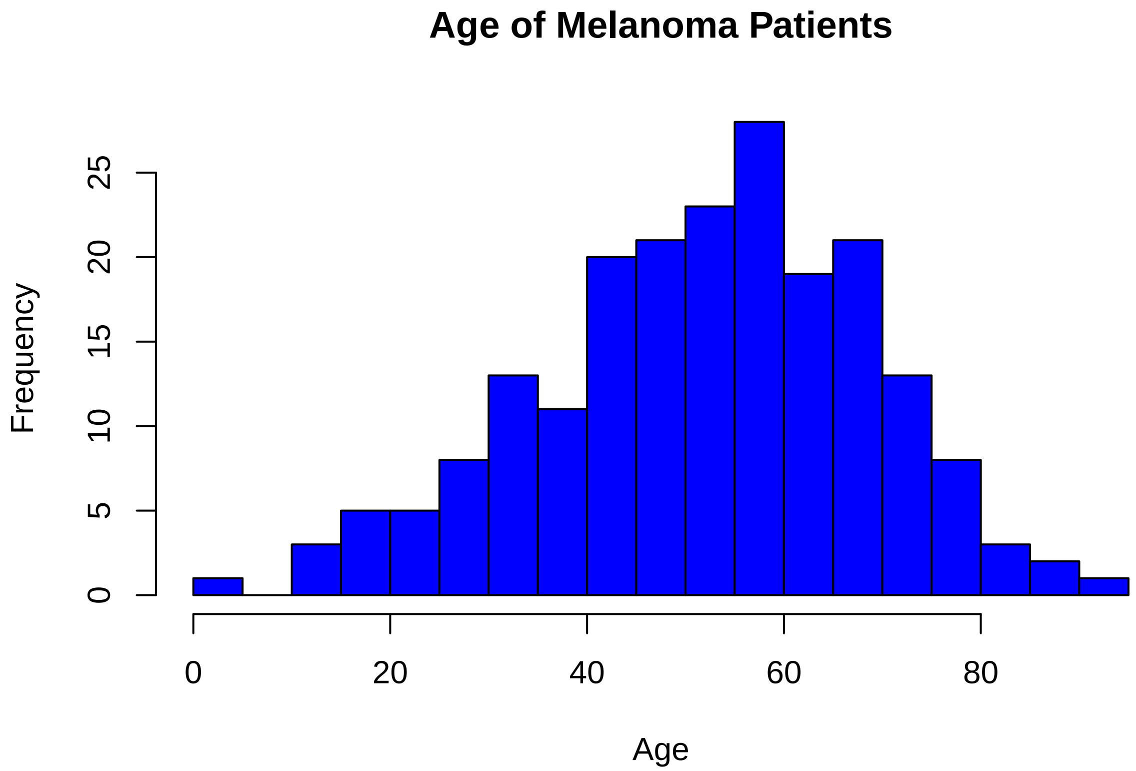
Also Every time you knit your file, you'll notice that the documentation for each ?data entry opens a webpage. If that bothers you, you may delete that code or place # in front to prevent it from running automatically.

```r
# starter
library(MASS)
?Melanoma
#View(Melanoma)
```

For the next several questions, we will be working with the `Melanoma` dataset from the `MASS` package.

Create a histogram of `age` in the `Melanoma` dataset. Please give your histogram 20 bins, label the x axis "Age", and provide the following plot title: "Age of Melanoma Patients"

```r
hist(Melanoma$age,xlab="Age",breaks=20,main="Age of Melanoma Patients",col="blue")
```



Exercise 2

Create a table that shows what proportion of patients in the dataset died of a melanoma, remained alive, or died from other causes.

Use an `R` command to produce this number.

```
result=table(Melanoma$status)
prop.table(result)
```

```
##
##          1          2          3
## 0.27804878 0.65365854 0.06829268
```

After running this result, directly answer what percent of patients in this dataset died of a melanoma (you don't need to extract this with `R` code–just answer directly as a statement below your code chunk.)

You can find information on what each status value means from the documentation!

```
answer=result/205
answer
```

```
##
##          1          2          3
## 0.27804878 0.65365854 0.06829268
```

The Percentage of patients that died of melanoma is 27.8% or 0.27804878 of the entire data set

Exercise 3

What is the average age of individuals in the `Melanoma` dataset who remained alive?

Hint: First, create a subset of patients who are alive. Then take the mean of the age variable from this subset. You can do it in two lines, or if you want to challenge yourself, do it in just one line!

```
mean(Melanoma$age[Melanoma$status=='2'])
```

```
## [1] 50.00746
```

50.00746 average age of individuals in the `Melanoma` dataset who remained alive

Exercise 4

```
#starter
library(MASS)
?mammals
```

We will now be using the `mammals` dataset from the `MASS` package.

Which animal in the `mammals` dataset has the largest brain weight relative to its body weight? (That is, the largest brain weight to body weight ratio.)

Hint: which.max might be helpful here.

Hint: Notice that names is not exactly a variable, but instead represent the actual row names. To extract the animal name only, use the rownames function around your subsetted row.

```
a = mammals$brain/(mammals$body*1000)
b = max(a)
z = a == b
rownames(mammals)[z]
```

```
## [1] "Ground squirrel"
```

```
#View(mammals)
```

Ground squirrel has the largest brain weight relative to its body weight

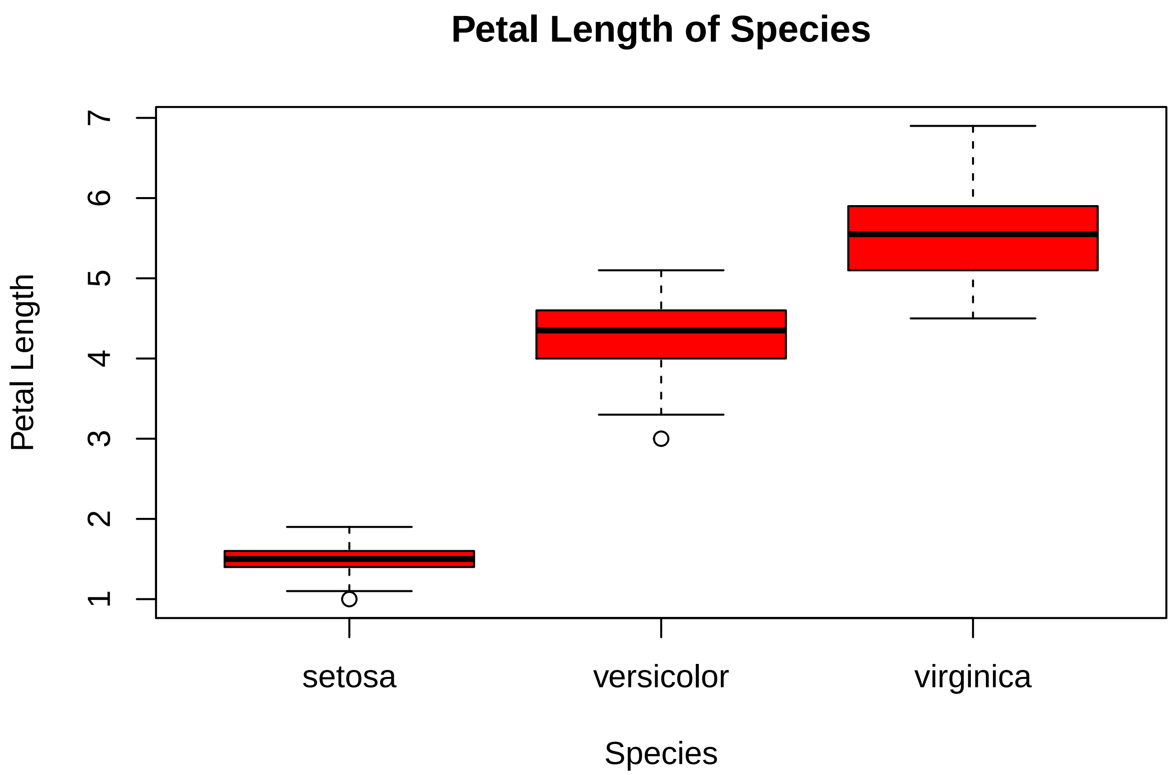
Exercise 5

```
#starter
?iris
```

The iris dataset is built into base R and thus requires no package to load.

Create side by side boxplots that comparePetal.Length of the three different species of iris plants in the dataset. Color the fill of your boxplots red, re-label the y axis as “Petal Length”, and title the plot “Petal Length of Species”

```
boxplot(Petal.Length ~ Species, data = iris, ylab = "Petal Length", main = 'Petal Length of Species',co
```



Exercise 6

```
#starter
?airquality
#View(airquality)
```

Using the airquality dataset, what is the average wind speed in May ?

```
mean(airquality$Wind[airquality$Month=='5'])
```

```
## [1] 11.62258
```

The average wind speed in May is 11.62258

Exercise 7

Using the `airquality` dataset, what is the average ozone measurement? Hint: read the documentation of any function that returns an unexpected result. You will likely find a solution to the issue.

```
mean(as.numeric(airquality$Ozone),na.rm=TRUE)
```

```
## [1] 42.12931
```

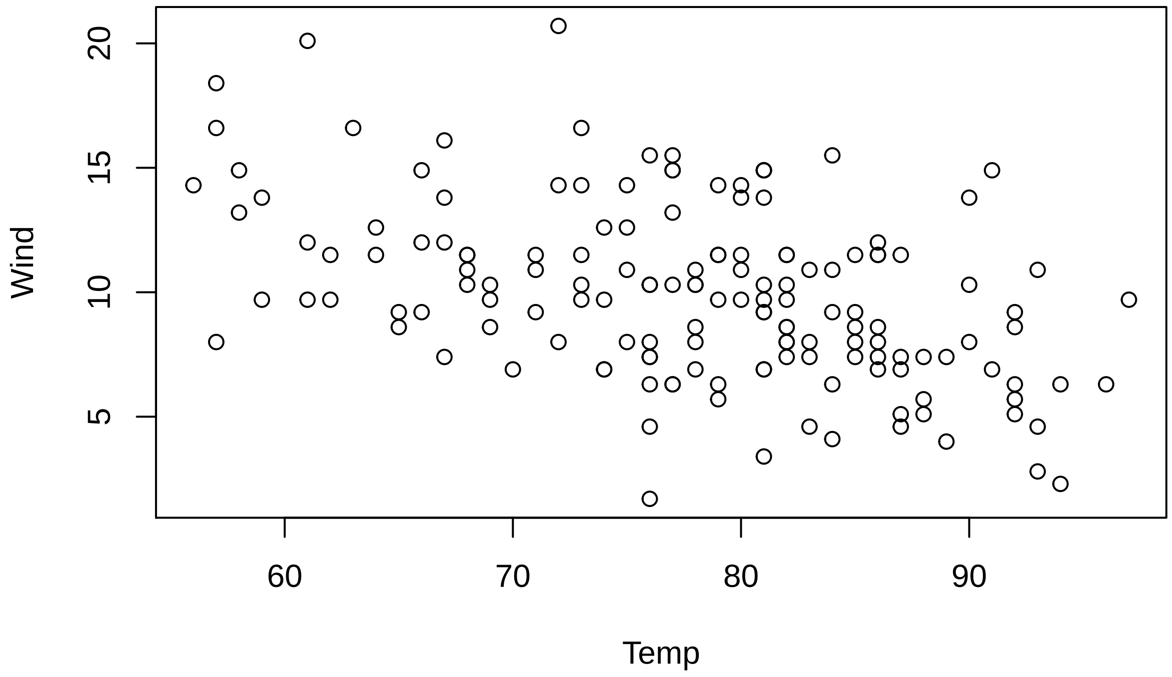
The average ozone measurement is 42.12931

Exercise 8

Using the `airquality` dataset, create a scatter plot to compare windspeed and temperature. Based on this plot, what appears to be true?

- Wind speed and temperature have no relationship.
- As temperature increases, wind speed slightly increases on average.
- As temperature increases, wind speed slightly decreases on average

```
plot(Wind ~ Temp, data=airquality)
```



Wind speed and temperature have no relationship: False

As temperature increases, wind speed slightly increases on average: False

As temperature increases, wind speed slightly decreases on average: True

Exercise 9

Consider a random variable X that has a normal distribution with a **mean** of 5 and a **variance** of 9. Calculate $P[X > 4]$.

Hint: Remember that the norm commands use standard deviations as inputs, not variance.

Hint: By default `pnorm()` considers area under the curve to the left of the given value.

```
val=pnorm(4,5,3,lower.tail = FALSE)
val
```

```
## [1] 0.6305587
```

Exercise 10

```
#starter
set.seed(42)
```

Let's assume that the number of minutes between calls at a help center follow a poisson distribution with lambda = 6. Run the seed code provided above, and then create a dataset titled `calls` that represents minutes between calls to that help center for a random sample of 500 calls.

```
n=500
lambda = 6
x = rpois(n, lambda)
```

It typically takes the caller just over 2 minutes to receive the call, take down the message, and resolve the issue or send the caller to someone who can. Using the simulated data, calculate the percentage of times that a call came in within 2 minutes of the previous call.

```
percent=sum(x<=2)/length(x)
percent*100
```

```
## [1] 6.4
```

The percentage of times that a call came in within 2 minutes of the previous call is 6.4%

Hint: Remember that calls will be a vector, not a data frame. Therefore, `nrow` will not work here. You'll want to use `length`.

Now, use the ppois function to calculate the expected percentage of the time the call center should expect calls within 2 minutes or less

```
ppois(2,lambda)*100
```

```
## [1] 6.19688
```

The expected percentage of the time the call center should expect calls within 2 minutes or less is 6.19688%

Exercise 11 (Bonus)

```
#starter
?airquality
```

Let's return to the airquality dataset again. Might there be a difference in the average windspeed in the month of May (month 5) as compared to the month of September (month 9)?

First, create a subset of the airquality data that only includes these two months. Name it `Air_Comparison`

```
may_as = airquality[airquality$Month == 5, ]
sept_as = airquality[airquality$Month == 9, ]
Air_Comparison = rbind(may_as, sept_as)
head(Air_Comparison)
```

```
##   Ozone Solar.R Wind Temp Month Day
## 1    41     190  7.4   67     5   1
## 2    36     118  8.0   72     5   2
## 3    12     149 12.6   74     5   3
## 4    18     313 11.5   62     5   4
## 5    NA      NA 14.3   56     5   5
## 6    28      NA 14.9   66     5   6
```

Ignore the warning: "longer object length is not a multiple of shorter object length"

Second, let's assume this data represents a random sample of air data. Run a two-sample t-test to compare the means and determine if there is evidence that May and September have different wind speeds on average.

Exercise 12 (Bonus)

Continued from Exercise 11: Which conclusion is most appropriate to make regarding our t-test comparison in the previous exercise?

- We have found evidence that May and September have equal wind speeds on average
- We have found evidence that May and September have non-equal wind speeds on average
- There is not enough evidence to conclude a difference in average wind speeds between May and September

```
t.test(Air_Comparison[Air_Comparison$Month == 5,]$Wind, Air_Comparison[Air_Comparison$Month == 9,]$Wind
```

```
##
##  Welch Two Sample t-test
##
## data:  Air_Comparison[Air_Comparison$Month == 5, ]$Wind and Air_Comparison[Air_Comparison$Month == 9
## t = 1.6112, df = 58.99, p-value = 0.1125
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -0.3490012  3.2341625
## sample estimates:
## mean of x mean of y
##  11.62258  10.18000
```

We have found evidence that May and September have non-equal wind speeds on average