Maps in R: Exercises

These exercises accompany the Maps in R tutorial: http://rpubs.com/NateByers/Maps. These exercises use daily No$_2$ data for the United States in 2014. Run the following code to clean out your global environment and load the data you need:

```
rm(list = ls())
library(dplyr)
library(region5air)
data(no2_2014)
```

If you are curious about where this data came from, see the Download section below.

Exercises

1. Use `dplyr` to create a data frame called `no2_max`. It should be a filtered subset of the `no2_2014` data frame so that each monitor has one record with the highest 1-hour NO$_2$ maximum for the entire year. **Hint:** Take a look at the column names, `names(no2_2014)`. Use `group_by()` to group by state, county, and site. Use `filter()` to find which 1st-max-value is equal to the maximum of the 1st-max-value column (use `==`).

Solution 1

2. Make a map of NO$_2$ monitors. Use `map(database = 'usa')` to make a map of the US first. Then use `points()` to add the monitors from the `no2_max` data frame.

Solution 2

3. Use `filter()` to make a new data frame of NO$_2$ motors that had a 1 hour max value above 100 ppb. Call the new data frame `no2_violations` and map those monitors.

Solution 3

4. Use the `leaflet` package to make an interactive map of the monitors in the `no2_violations` data frame.

Solution 4

Advanced Exercise

5. Use the `choroplethr` package to make a heat map of the number of NO$_2$ monitors in each state. **Hint:** You will need to make a new data frame called `no2_monitors`. Start with the `no2_max` data frame and group by state. Use the `summarize()` function to get the total number of monitors in each group. The `n()` function will count the total number of rows in a group.

Solution 5

Solutions

Solution 1 Here are the columns.

```
names(no2_2014)
```

```
##  [1] "State.Code"          "County.Code"         "Site.Num"
##  [4] "Parameter.Code"      "POC"                 "Latitude"
##  [7] "Longitude"           "Datum"               "Parameter.Name"
## [10] "Sample.Duration"     "Pollutant.Standard"  "Date.Local"
## [13] "Units.of.Measure"    "Event.Type"          "Observation.Count"
## [16] "Observation.Percent" "Arithmetic.Mean"     "X1st.Max.Value"
## [19] "X1st.Max.Hour"       "AQI"                 "Method.Code"
## [22] "Method.Name"         "Local.Site.Name"     "Address"
## [25] "State.Name"          "County.Name"         "City.Name"
## [28] "CBSA.Name"           "Date.of.Last.Change"
```

Now we know the column names for state, county, and site. Let's group by those columns.

```
no2_max <- group_by(no2_2014, State.Name, County.Name, Site.Num)
```

Now we'll filter the data frame so that the "X1st.Max.Value" is equivalent to the maximum for each group.

```
no2_max <- filter(no2_max, X1st.Max.Value == max(X1st.Max.Value, na.rm = TRUE))
```

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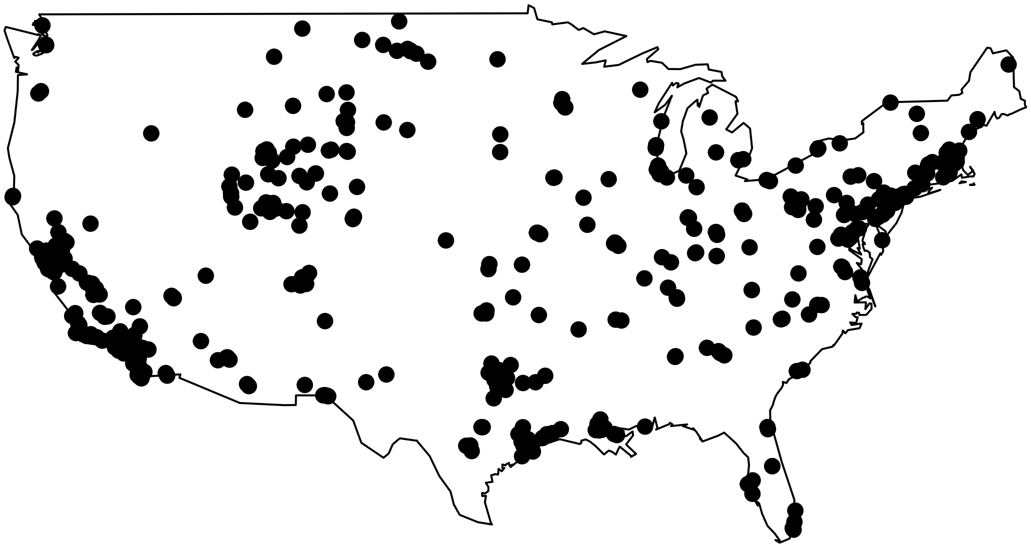
```


library(maps)
map(database = 'usa')
points(x = no2_max$Longitude, y = no2_max$Latitude, pch = 19)
```



Solution 2

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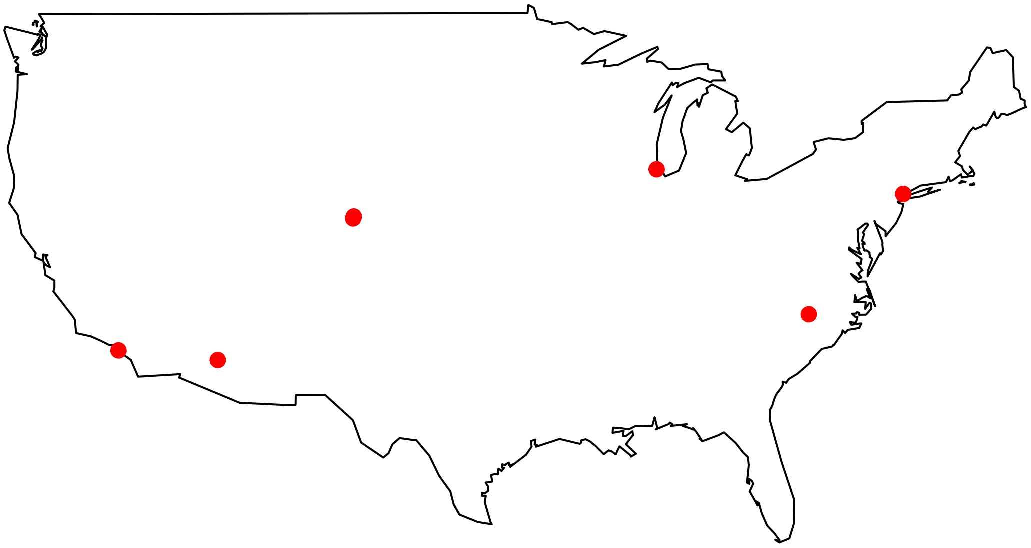
```
no2_violations <- filter(no2_max, X1st.Max.Value > 100)
map(database = 'usa')
points(x = no2_violations$Longitude, y = no2_violations$Latitude, pch = 19,
       col = "red")
```



Solution 3

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```
library(leaflet)
m <- leaflet()
m <- addTiles(m)
m <- addMarkers(m, lng=no2_violations$Longitude, lat=no2_violations$Latitude,
                popup=no2_violations$CBSA.Name)
m
```

Solution 4 Back to exercises

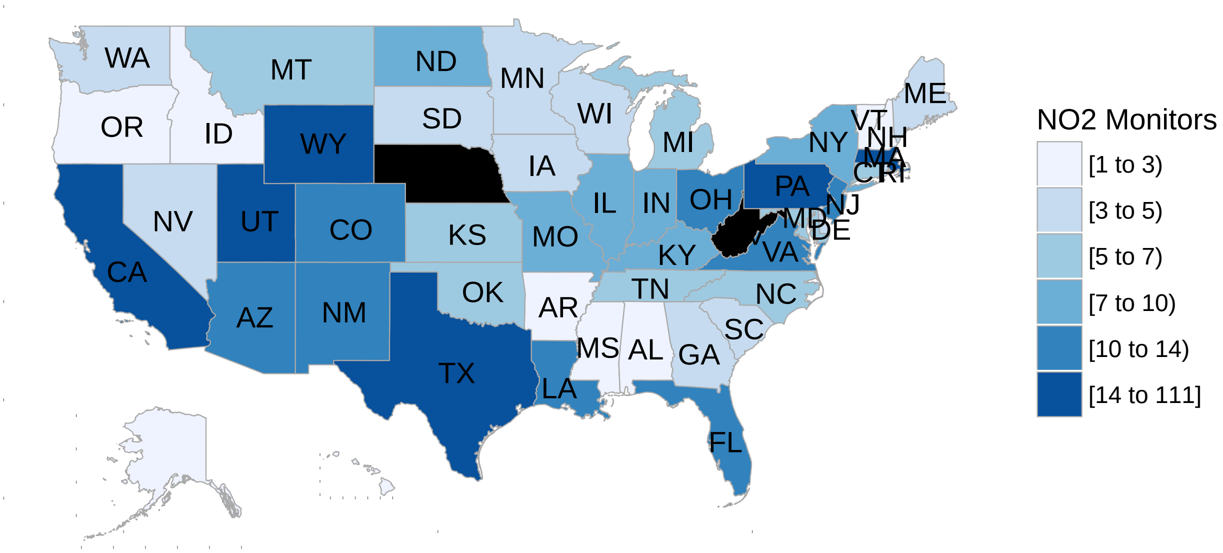
```
no2_monitors <- group_by(no2_max, State.Name)
no2_monitors <- summarize(no2_monitors, value = n())
```

Solution 5 The choroplethr package wants full state names with lower case. So we need to remove Puerto Rico, turn the state values to all lower case, and rename the state column to “region”

```
no2_monitors <- filter(no2_monitors, State.Name != "Puerto Rico")
no2_monitors <- mutate(no2_monitors, State.Name = tolower(State.Name))
no2_monitors <- rename(no2_monitors, region = State.Name)
```

Now we can make the map.

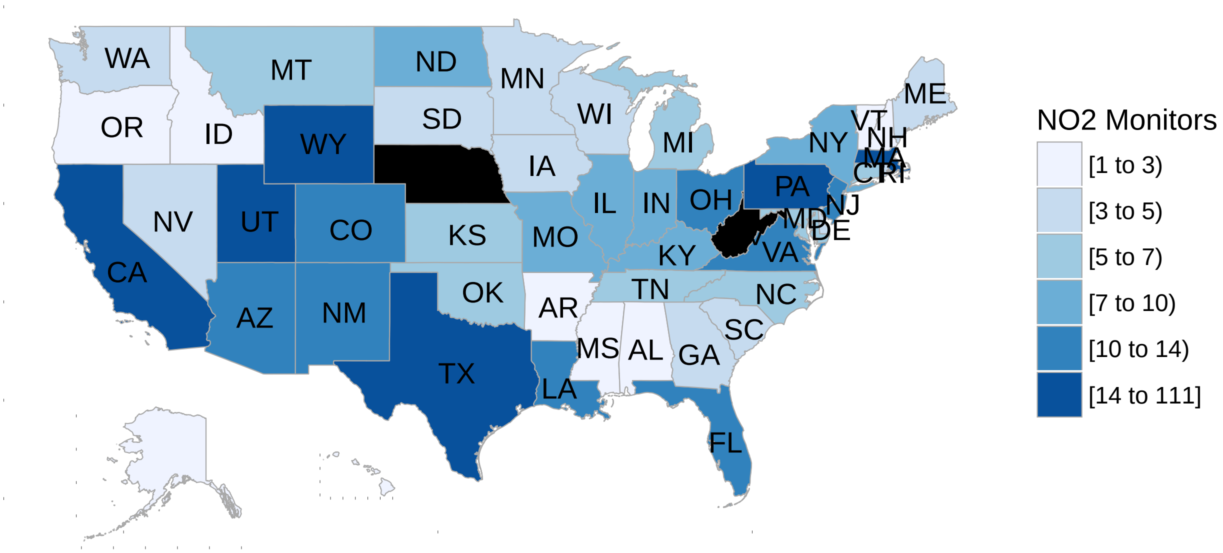
```
library(choroplethr)
no2_map <- state_choropleth(no2_monitors, legend = "NO2 Monitors")
no2_map
```



Just for fun, let’s see that with pipes.

```
no2_map_piped <- no2_max %>%
  group_by(State.Name) %>%
  summarize(value = n()) %>%
  filter(State.Name != "Puerto Rico") %>%
  mutate(State.Name = tolower(State.Name)) %>%
  rename(region = State.Name) %>%
  state_choropleth(legend = "NO2 Monitors")

no2_map_piped
```



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Download

Below is the code for retrieving the `no2_2014` data frame from the EPA website.

```r
# create a temporary file
temp <- tempfile()

# download the .zip file to a temporary file--this might take a minute or two
download.file('http://aqsdr1.epa.gov/aqsweb/aqstmp/airdata/daily_42602_2014.zip', temp)

# read the .csv file into R
no2 <- read.csv(unz(temp, 'daily_42602_2014.csv'), stringsAsFactors = FALSE)

# delete the temporary file
unlink(temp)
```