MATH 118: Notes M

Code

More Maps

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```
#LOAD PACKAGES
library(tidyverse)
library(sf) #this is a package needed so R can work with sf objects

#LOAD DATA
library(spData) #this packages contains the dataset (with sf objects) that we will be using today
data("us_states")
```

More `sf` maps with points

Recall our map of the continential US which shows the state borders.

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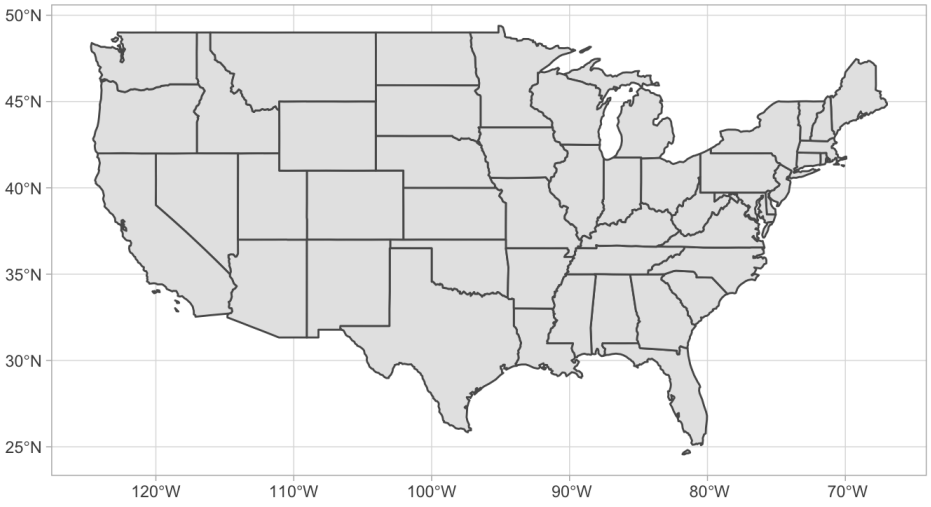
```
us_states %>%
ggplot() +
  geom_sf() +
  theme_light()
```



Recall the `nycflights13` dataset which had all kinds information about all the flights out of NYC airports in 2013. Check out the `airports` dataset, which has the latitude and longitude of all airports in the USA.

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```
library(nycflights13)
data(airports)
```

Suppose we want to plot these onto our map:

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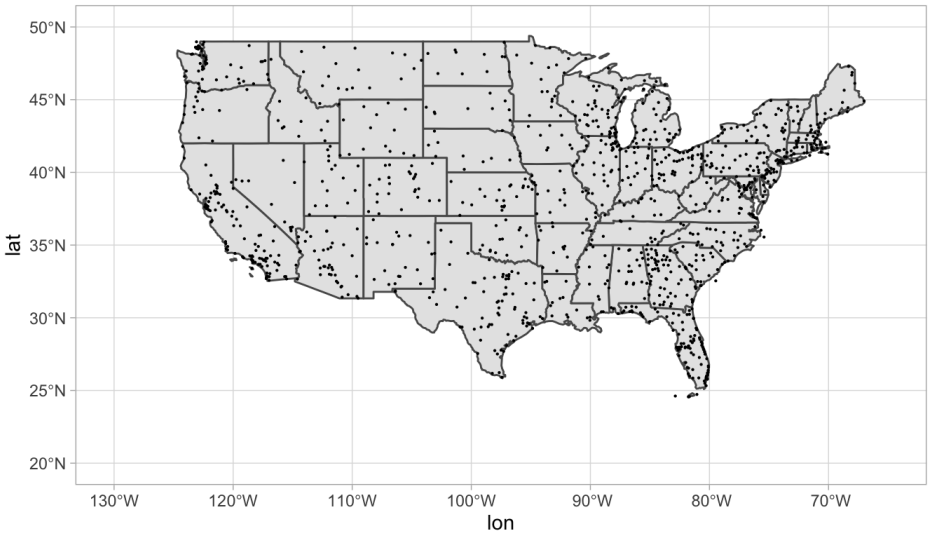
```
us_states %>%
ggplot() +
  geom_sf() +
  theme_light() +
  geom_point(data=airports, aes(x=lon, y=lat), pch=19, size=0.1) +
  coord_sf(xlim = c(-130, -65),
           ylim = c(20, 50))
```



What if we wanted to have each dot size represent the number of flights that flew to those airports from NYC? First we need the data:

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```
data(flights)

dest_count <- flights %>%
  group_by(dest) %>%
  summarize(count=n())
```

Then we need to merge this data into the `airports` dataset:

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```
airports_count <- airports %>%
  inner_join(dest_count, by=c("faa" = "dest"))
```

Then we can add it to our plot:

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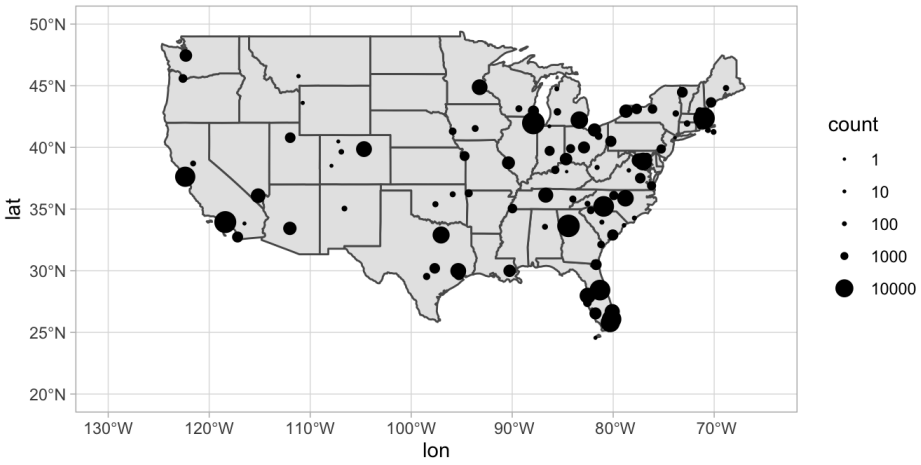
```
us_states %>%
ggplot() +
  geom_sf() +
  theme_light() +
  geom_point(data=airports_count, aes(x=lon, y=lat, size=count)) +
  scale_size(range = c(0.2,5), breaks=c(0,1,10,100,1000,10000,100000))+
  coord_sf(xlim = c(-130, -65),
           ylim = c(20, 50))
```



Leaflet

Leaflet is one of the most popular open-source JavaScript libraries for interactive maps.

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```
library(leaflet)
```

You create a Leaflet map with these basic steps:

1. Create a map widget by calling leaflet().
2. Add layers (i.e., features) to the map by using layer functions (e.g. `addTiles`, `addMarkers`, `addPolygons`) to modify the map widget.
3. Repeat step 2 as desired.
4. Print the map widget to display it.

Using OpenStreet Maps

A simple map of Warner Hall:

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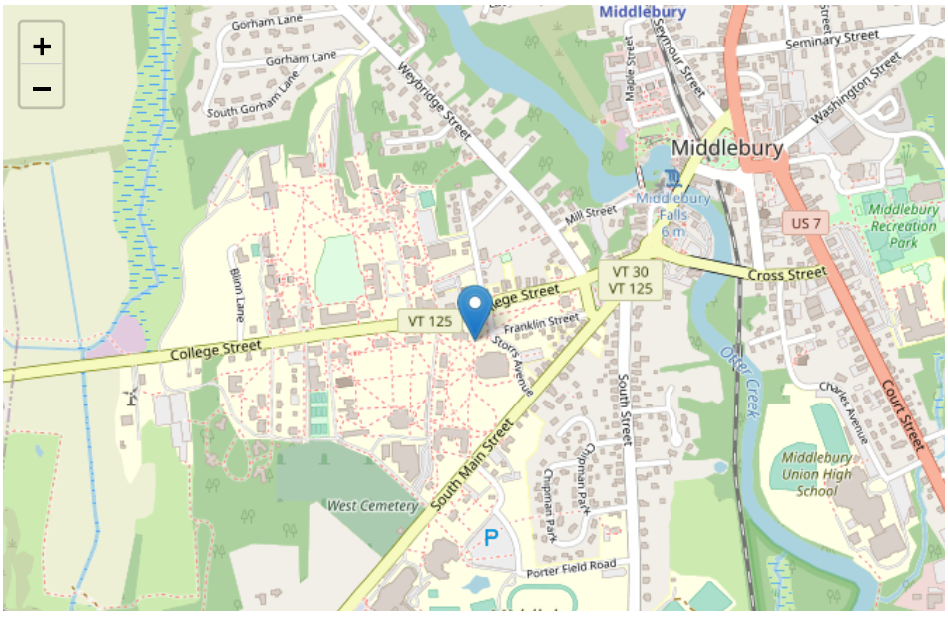
```
leaflet() %>%
  addTiles() %>%  # Add default OpenStreetMap map tiles
  addMarkers(lng=-73.175, lat=44.010, popup="Warner Hall")
```



A map of all airports in the USA:

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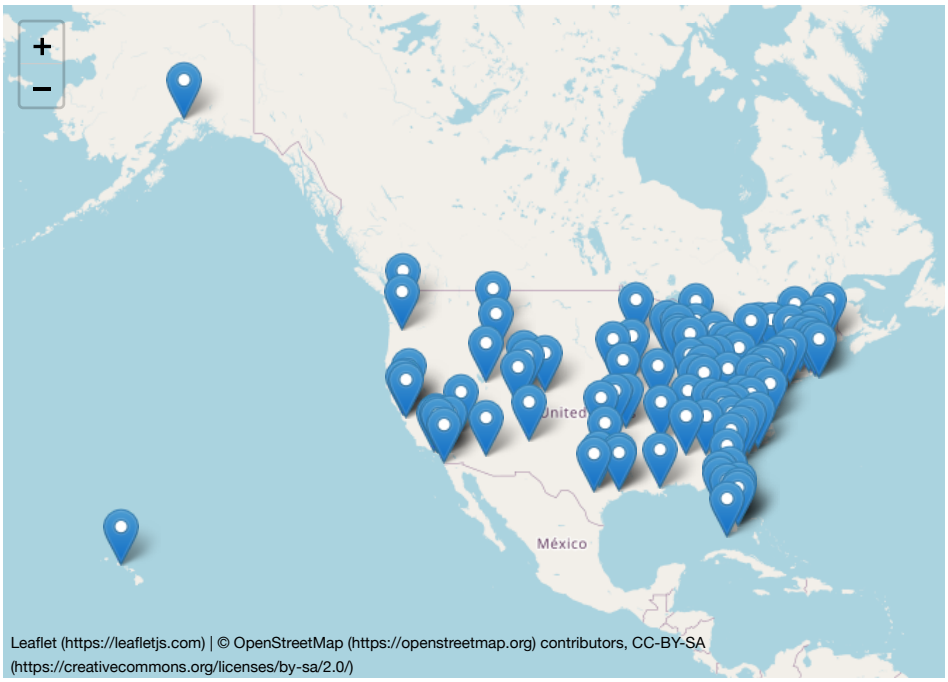
```
leaflet(data=airports_count) %>%
  addTiles() %>%  # Add default OpenStreetMap map tiles
  addMarkers(lng=~lon, lat=~lat, popup=~faa)
```



or using Circle Markers:

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```
leaflet(data=airports_count) %>%
  addTiles() %>%  # Add default OpenStreetMap map tiles
  addCircleMarkers(lng=~lon, lat=~lat, popup=~faa, radius = ~count/1000, stroke = FALSE, fillOpacity = 0.5)
```