Map Graphics with ggplot2

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Graphs using Maps

The maps package draws lines and polygons corresponding to different maps (US by state, US by county, world, etc) in the map database. You can then use a `geom_map()` layer in ggplot2 to fill maps with colors that represent some numeric or categorical variable of interest. Let's draw some maps first:

```
> require(maps)
> #?map  #to see the maps available and how to specify the desired regions
> map('county','california')
```

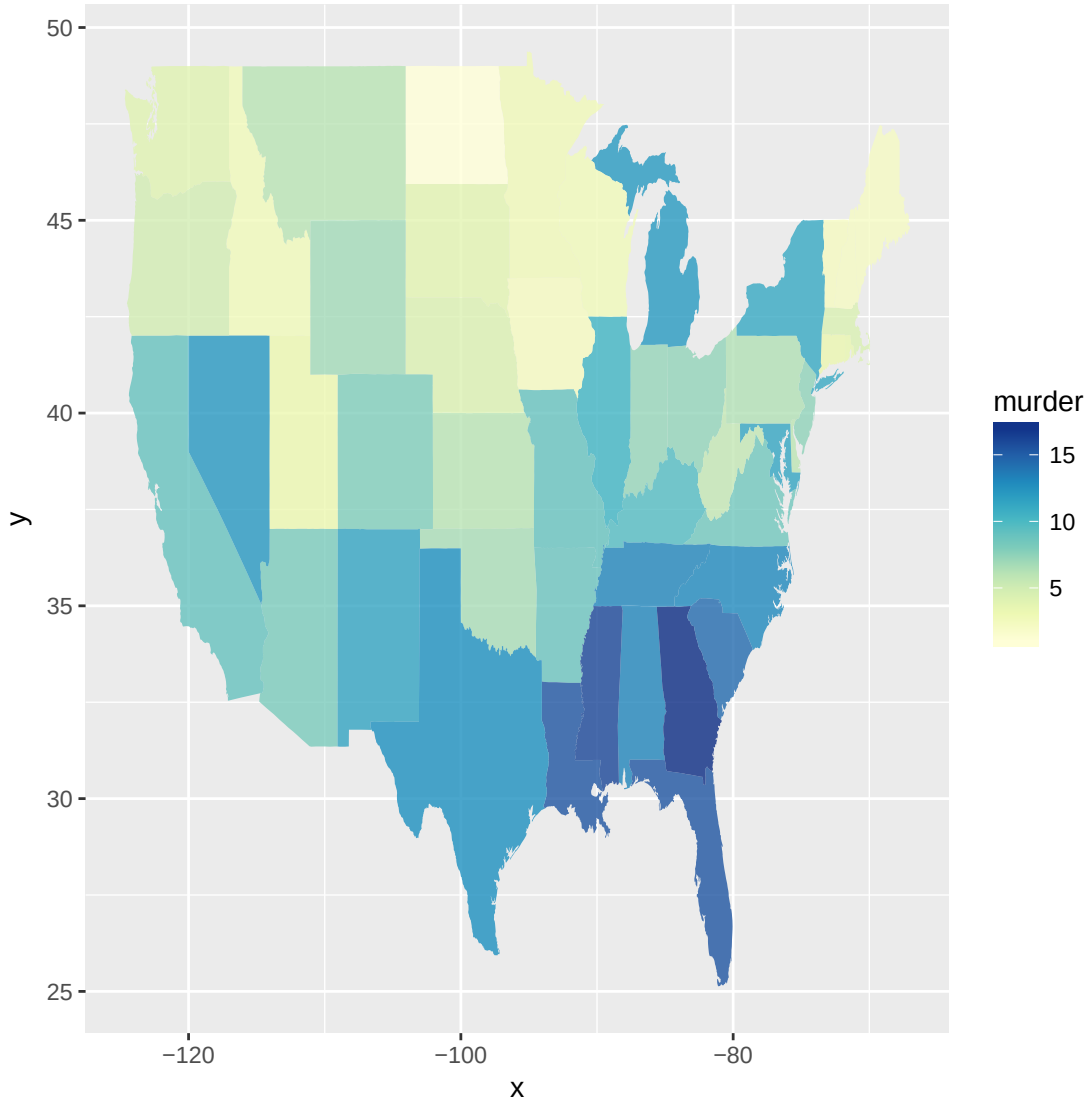
The `map_data(map,region)` creates a dataframe of the coordinates defining the borders of the regions in the chosen map.

```
> require(ggplot2)
> Mymapcoordinates <- map_data(map="state")
> head(Mymapcoordinates)

       long      lat group order  region subregion
1 -87.46201 30.38968     1     1 alabama      <NA>
2 -87.48493 30.37249     1     2 alabama      <NA>
3 -87.52503 30.37249     1     3 alabama      <NA>
4 -87.53076 30.33239     1     4 alabama      <NA>
5 -87.57087 30.32665     1     5 alabama      <NA>
6 -87.58806 30.32665     1     6 alabama      <NA>
```

To create a map of the US where the color of each state represents some variable of interest, you need TWO dataframes. One containing the coordinates used to draw the states and the other containing the variables for each state that you wish to represent in the graph. These two dataframes must be linked by a common variable so the variable for each state can be associated with the coordinates used to draw that state.

```
> library(maps)
> library(RColorBrewer)
> crime.data.by.state <- data.frame(murder = USArrests$Murder,state = tolower(rownames(USArrests))) #change s
> my.map.coordinates <- map_data("state")  #access database of coordinates needed to draw shapes of each stat
> myplot <- ggplot(crime.data.by.state, aes(fill = murder))+geom_map(aes(map_id = state), map =my.map.coordin
> myplot
```



The geom_map argument `map` is a "data frame that contains the map coordinates...It must contain columns x or long, y or lat, and region or id." (from the help file for map()). The map_id argument must contain the name of the column which links the data frame with the map coordinates to the data frame with the variable(s) for each state.

Note the `expand_limit()` layer widens the x- and y-axes enough to accomodate all the values in `x=map$long` and `y=map$lat`.

Exercise

1. Plot the world map with countries (just using the map() command).
2. Modify the last code chunk in this document to display the percent of population in urban areas in the USArrests data frame by state in the map of the US.