Lab 1 - Data visualization

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Load Packages

```
library(tidyverse)
```

```
Warning in system("timedatectl", intern = TRUE): running command 'timedatectl'
had status 1
```

```
library(viridis)
```

Exercise 1

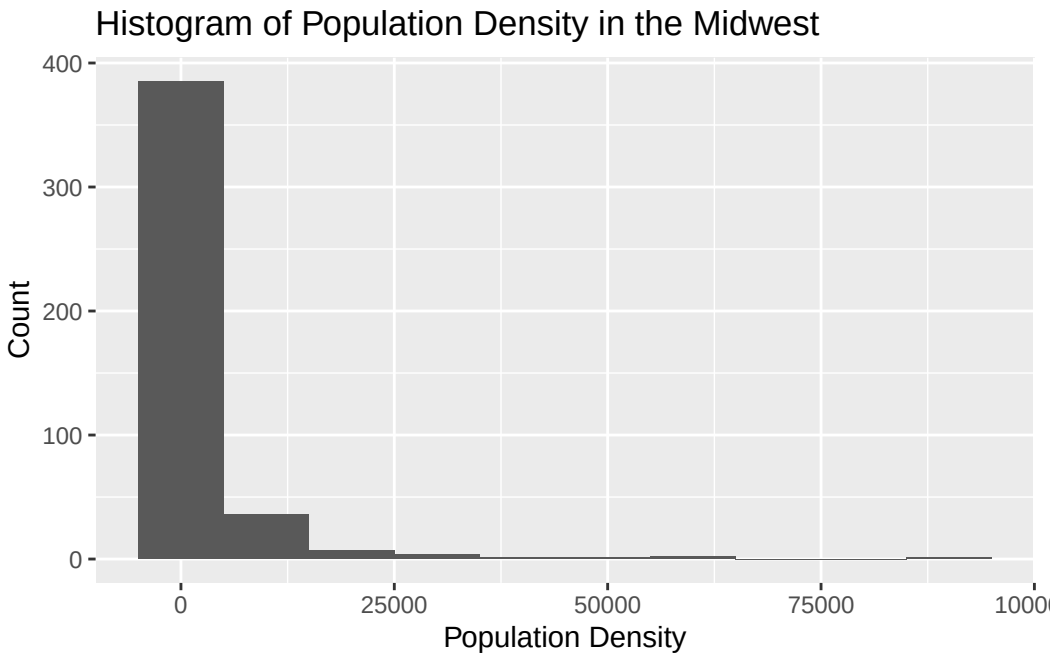
```
glimpse(midwest)
```

```
Rows: 437
Columns: 28
$ PID                 <int> 561, 562, 563, 564, 565, 566, 567, 568, 569, 570,~
$ county              <chr> "ADAMS", "ALEXANDER", "BOND", "BOONE", "BROWN", "~
$ state               <chr> "IL", "IL", "IL", "IL", "IL", "IL", "IL", "IL", "~
$ area                <dbl> 0.052, 0.014, 0.022, 0.017, 0.018, 0.050, 0.017, ~
$ poptotal            <int> 66090, 10626, 14991, 30806, 5836, 35688, 5322, 16~
$ popdensity          <dbl> 1270.9615, 759.0000, 681.4091, 1812.1176, 324.222~
$ popwhite            <int> 63917, 7054, 14477, 29344, 5264, 35157, 5298, 165~
$ popblack            <int> 1702, 3496, 429, 127, 547, 50, 1, 111, 16, 16559,~
$ popamerindian       <int> 98, 19, 35, 46, 14, 65, 8, 30, 8, 331, 51, 26, 17~
$ popasian            <int> 249, 48, 16, 150, 5, 195, 15, 61, 23, 8033, 89, 3~
$ popother            <int> 124, 9, 34, 1139, 6, 221, 0, 84, 6, 1596, 20, 7, ~
$ percwhite           <dbl> 96.71206, 66.38434, 96.57128, 95.25417, 90.19877,~
$ percblack           <dbl> 2.57527614, 32.90043290, 2.86171703, 0.41225735, ~
```

```
$ percamerindan        <dbl> 0.14828264, 0.17880670, 0.23347342, 0.14932156, 0~
$ percasian            <dbl> 0.37675897, 0.45172219, 0.10673071, 0.48691813, 0~
$ percother            <dbl> 0.18762294, 0.08469791, 0.22680275, 3.69733169, 0~
$ popadults            <int> 43298, 6724, 9669, 19272, 3979, 23444, 3583, 1132~
$ perchsd              <dbl> 75.10740, 59.72635, 69.33499, 75.47219, 68.86152,~
$ percollege           <dbl> 19.63139, 11.24331, 17.03382, 17.27895, 14.47600,~
$ percprof             <dbl> 4.355859, 2.870315, 4.488572, 4.197800, 3.367680,~
$ poppovertyknown      <int> 63628, 10529, 14235, 30337, 4815, 35107, 5241, 16~
$ percpovertyknown     <dbl> 96.27478, 99.08714, 94.95697, 98.47757, 82.50514,~
$ percbelowpoverty     <dbl> 13.151443, 32.244278, 12.068844, 7.209019, 13.520~
$ percchildbelowpovert <dbl> 18.011717, 45.826514, 14.036061, 11.179536, 13.02~
$ percadultpoverty     <dbl> 11.009776, 27.385647, 10.852090, 5.536013, 11.143~
$ percelderlypoverty   <dbl> 12.443812, 25.228976, 12.697410, 6.217047, 19.200~
$ inmetro              <int> 0, 0, 0, 1, 0, 0, 0, 0, 0, 1, 0, 0, 0, 1, 0, 1, 0~
$ category             <chr> "AAR", "LHR", "AAR", "ALU", "AAR", "AAR", "LAR", ~
```

```
view(midwest)
```

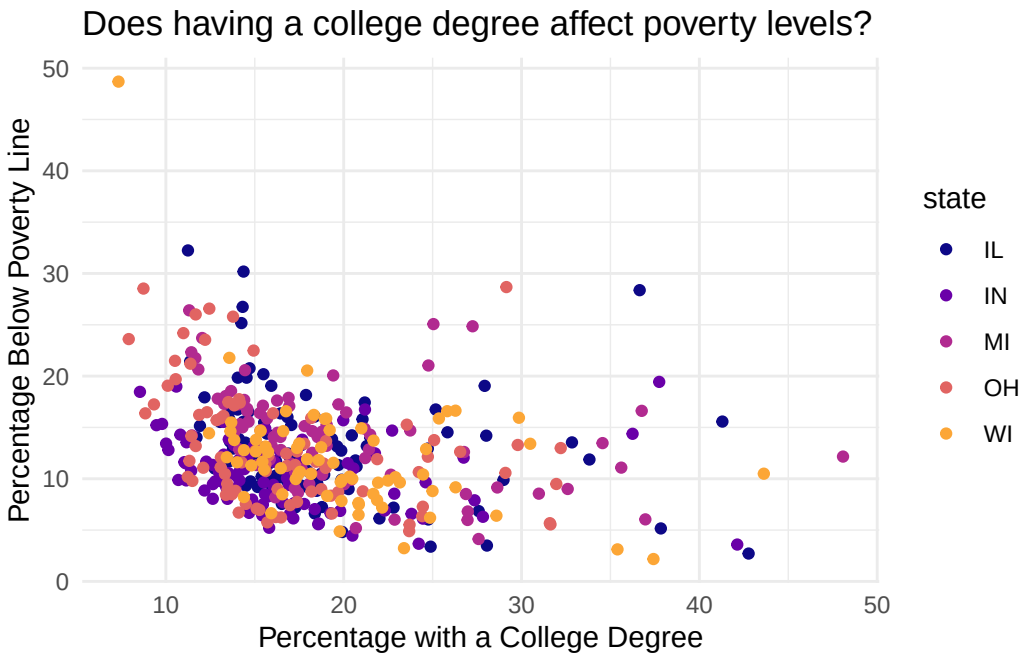
```
#this creates a histogram for population density
ggplot(data = midwest, aes(x = popdensity)) +
  geom_histogram(binwidth = 10000) +
 labs(title = "Histogram of Population Density in the Midwest",
      x= "Population Density", y = "Count")
```



The graph is right-skewed. There are a few outliers: one between 50,000 and 75,000, and another one between 75,000 and 100,000.

Exercise 2

```
ggplot(data = midwest, aes(x = percollege,
                           y = percbelowpoverty, color = state))+
  geom_point()+
  labs(title = "Does having a college degree affect poverty levels?",
       y = "Percentage Below Poverty Line",
       x = "Percentage with a College Degree") +
  scale_color_viridis_d(option = "C", end = 0.8) +
  theme_minimal()
```



Exercise 3

Describe what you observe in the plot from the previous exercise. In your description, include similarities and differences in the patterns across states.

The scatterplot is trying to show how the % of ppl below the poverty rate might change depending on the % of people with a college education (how Y changes with X). We can see that when 50% of individuals have a college degree, they are a minority in being below the poverty line.

With lower percentages of college degrees, the percentage of being below the poverty line is higher. Generally, all the states average out to 10-20% having a college degree and around 10-20% of these individuals being under the poverty line.

Illinois has the highest percentage of individuals under the poverty line, while Wisconsin has the lowest percentage of individuals under the poverty line.

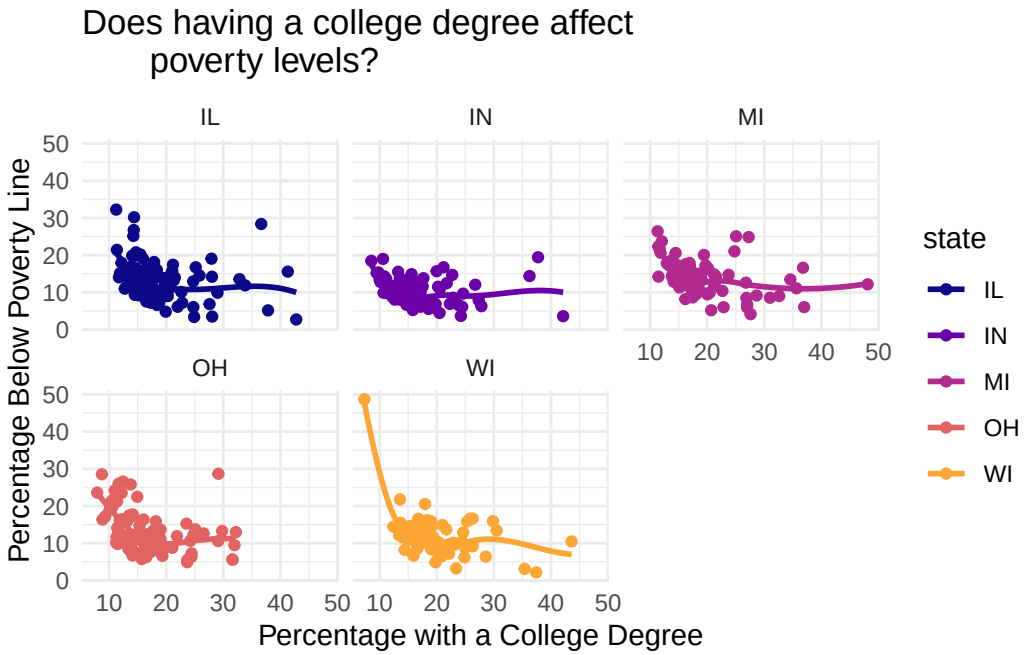
Exercise 4

Now, let's examine the relationship between the same two variables, using a separate plot for each state. Label the axes and give the plot a title. Use `geom_smooth` with the argument `se`

= FALSE to add a smooth curve fit to the data. Which plot do you prefer - this plot or the plot in Ex 2? Briefly explain your choice.

```
ggplot(data = midwest, aes(x = percollege,
                           y = percbelowpoverty,
                           color = state))+
  geom_point()+
  labs(title = "Does having a college degree affect
       poverty levels?", y = "Percentage Below Poverty Line",
       x = "Percentage with a College Degree") +
  facet_wrap(~state)+
  scale_color_viridis_d(option = "C", end = 0.8) +
  theme_minimal() +
  geom_smooth(se = FALSE)
```

```
`geom_smooth()` using method = 'loess' and formula 'y ~ x'
```

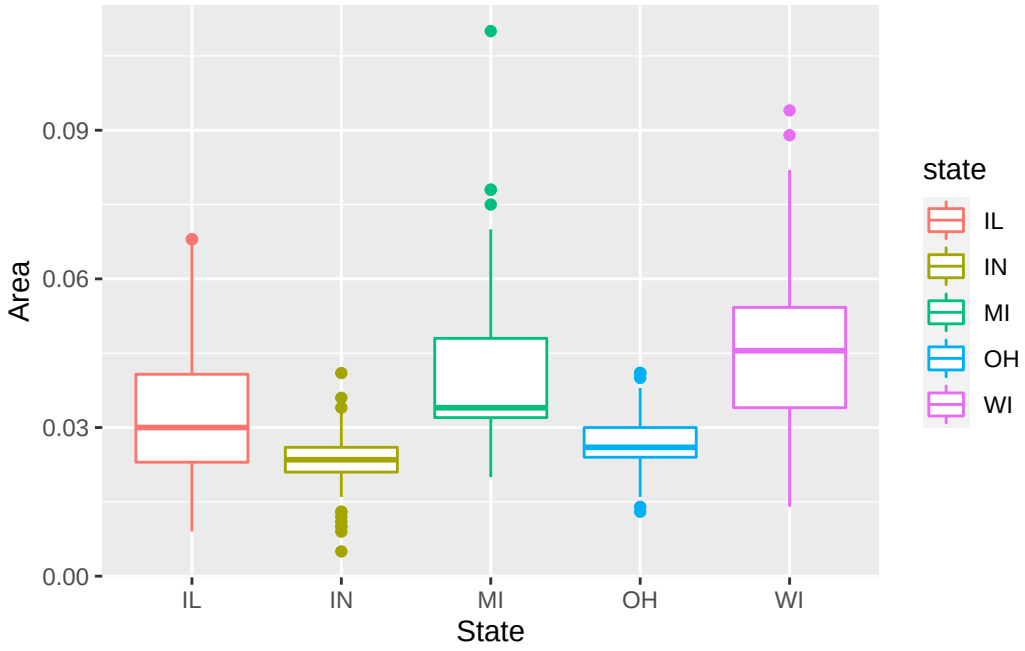


I prefer this plot because it is easier on the eyes and the data is organized more clearly and cleanly. You can see the association between the poverty line and college degree better, especially since it connects all the points based on distinct points.

Exercise 5

Do some states have counties that tend to be geographically larger than others? To explore this question, create side-by-side boxplots of area (`area`) of a county based on state (`state`).

```
ggplot(midwest,
       aes(x = state, y = area, color = state)) +
  geom_boxplot() +
  labs("Size of Counties by States in the Midwest",
       x = "State", y = "Area")
```



- Describe what you observe from the plot.

  From this plot, we can see the area of different counties in states in the Midwest.

- Which state has the single largest county? How do you know based on the plot?

Wisconsin has the single largest county because its box distribution is the largest in terms of area.

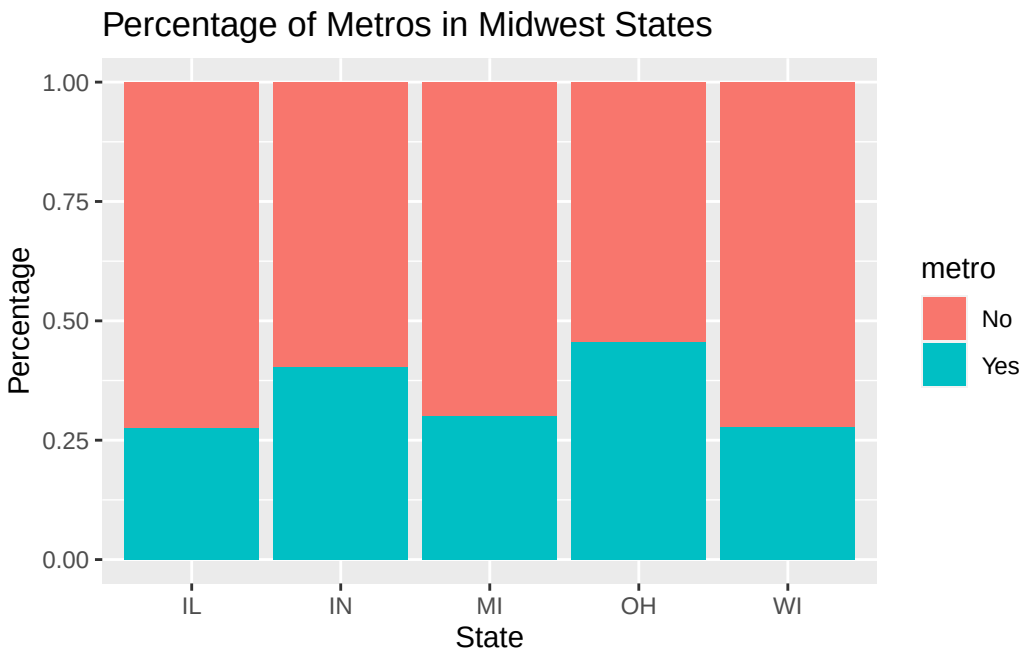
Exercise 6

Do some states have a higher percentage of their counties located in a metropolitan area? Create a segmented bar chart with one bar per state and the fill determined by the distribution of `metro`, whether a county is considered in a metro area. The y axis of the segmented barplot should range from 0 to 1.

- What do you notice from the plot?

```
midwest <- midwest |>
  mutate(metro = if_else(inmetro == 1, "Yes", "No"))
```

```
ggplot(midwest, aes(x=state, fill = metro))+
  geom_bar(position="fill")+
  labs(title = "Percentage of Metros in Midwest States",
       y = "Percentage", x = "State")
```



Exercise 7

```
ggplot(data = midwest,
       aes(x= percollege , y=popdensity, color = percollege)) +
  geom_point(show.legend = TRUE, size = 2, alpha = 0.5) +
  labs(title = "Do people with college degrees tend to live
       in denser areas?", x = "% of college educated",
       y = "Population density (person/unit area",
       fill = "% below \n poverty line")+
    facet_wrap(~state) +
  theme_minimal()
```