Lab 2 - Data wrangling

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```
library(tidyverse)
```

Questions

Part 1

```
?midwest
```

Question 1

```r
midwest |>
count(state, sort = TRUE)
```

```
# A tibble: 5 x 2
  state     n
  <chr> <int>
1 IL      102
2 IN       92
3 OH       88
4 MI       83
5 WI       72
```

Comment: Illinois has the most amount of counties with 102, and Wisconsin has the least with 72.

Question 2

```
midwest |>
  count(county,state) |>
  count(county, name = "n_states")|>
  filter(n_states == n_distinct(midwest$state))
```

```
# A tibble: 3 x 2
  county   n_states
  <chr>       <int>
1 CRAWFORD        5
2 JACKSON         5
3 MONROE          5
```

Question 3

```r
midwest |>
  filter(popdensity > 25000) |>
  select(county,state,popdensity,poptotal,area) |>
  arrange(desc(popdensity))
```

```
# A tibble: 9 x 5
  county    state popdensity poptotal  area
  <chr>     <chr>      <dbl>    <int> <dbl>
1 COOK      IL        88018.  5105067 0.058
2 MILWAUKEE WI        63952.   959275 0.015
3 WAYNE     MI        60334.  2111687 0.035
4 CUYAHOGA  OH        54313.  1412140 0.026
5 DU PAGE   IL        39083.   781666 0.02
6 MARION    IN        34659.   797159 0.023
7 HAMILTON  OH        34649.   866228 0.025
8 FRANKLIN  OH        28278.   961437 0.034
9 MACOMB    MI        25621.   717400 0.028
```

```r
midwest |>
  filter(popdensity == max(popdensity)) |>
  select(county,state,popdensity,poptotal,area)
```

```
# A tibble: 1 x 5
  county state popdensity poptotal  area
  <chr>  <chr>      <dbl>    <int> <dbl>
1 COOK   IL        88018.  5105067 0.058
```

Question 4

```
midwest|>
  summarize(
    median(popdensity),
    q1 = quantile(popdensity, 0.25),
    q3 = quantile(popdensity, 0.75)
  )
```

```
# A tibble: 1 x 3
  `median(popdensity)`    q1    q3
                 <dbl> <dbl> <dbl>
1                1156.  622.  2330
```

Comment:

The distribution of population density of counties is unimodal and extremely right-skewed. A typical Midwestern county has population density of 1156.208 people per unit area. The middle 50% of the counties have population densities between 622.4074 to 2330 people per unit area.

Question 5

```
midwest |>
  count(state,inmetro)|>
  group_by(state) |>
  mutate(prop=n/sum(n))
```

```
# A tibble: 10 x 4
# Groups:   state [5]
   state inmetro     n  prop
   <chr>   <int> <int> <dbl>
 1 IL          0    74 0.725
 2 IL          1    28 0.275
 3 IN          0    55 0.598
 4 IN          1    37 0.402
 5 MI          0    58 0.699
 6 MI          1    25 0.301
 7 OH          0    48 0.545
 8 OH          1    40 0.455
 9 WI          0    52 0.722
10 WI          1    20 0.278
```

Question 6

```
midwest |>
  filter(percbelowpoverty >=40,
         percollege <=10) |>
  select(county,state,
         percbelowpoverty,
         percollege)
```

```
# A tibble: 1 x 4
  county    state percbelowpoverty percollege
  <chr>     <chr>            <dbl>      <dbl>
1 MENOMINEE WI                48.7       7.34
```

```
midwest |>
  filter(percbelowpoverty <= 20,
         percollege >= 40) |>
  select(county, state,
         percbelowpoverty,
         percollege)
```

```
# A tibble: 5 x 4
  county    state percbelowpoverty percollege
  <chr>     <chr>            <dbl>      <dbl>
1 CHAMPAIGN IL               15.6        41.3
2 DU PAGE   IL                2.71       42.8
3 HAMILTON  IN                3.59       42.1
4 WASHTENAW MI               12.2        48.1
5 DANE      WI               10.5        43.6
```

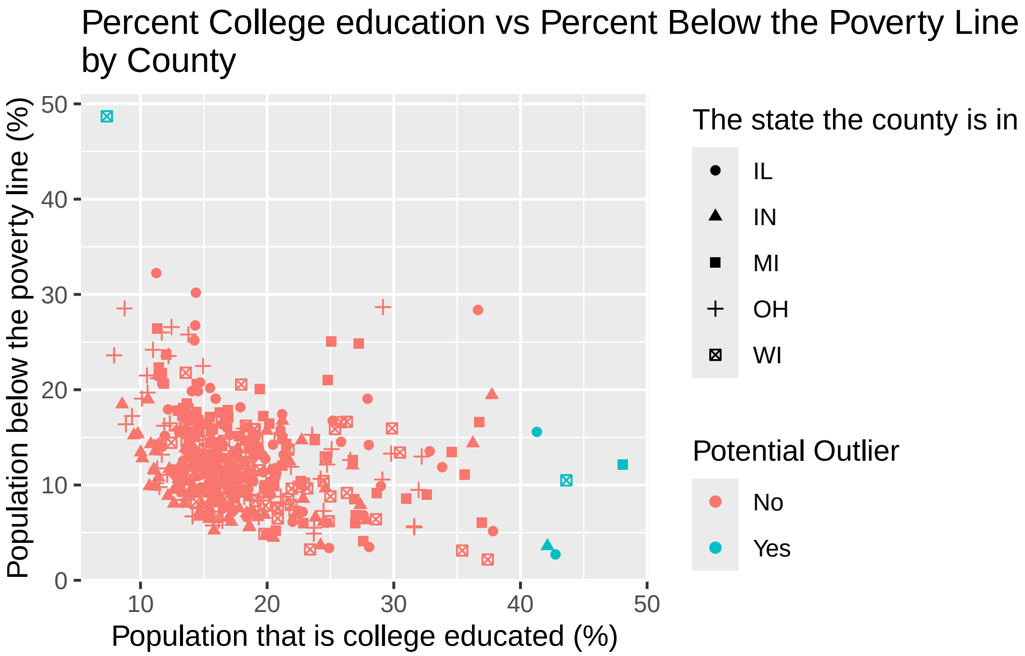
```
midwest |>
  filter(
    (percbelowpoverty >= 40 & percollege <= 10) |
  (percbelowpoverty <=20 & percollege >= 40)
) |>
  select(county, state,
         percbelowpoverty,
         percollege)
```

```
# A tibble: 6 x 4
  county    state percbelowpoverty percollege
  <chr>     <chr>            <dbl>      <dbl>
1 CHAMPAIGN IL               15.6       41.3 
2 DU PAGE   IL                2.71      42.8 
3 HAMILTON  IN                3.59      42.1 
4 WASHTENAW MI               12.2       48.1 
5 DANE      WI               10.5       43.6 
6 MENOMINEE WI               48.7        7.34
```

```
midwest |>
   mutate(
     potential_outlier = if_else(
       (percbelowpoverty >= 40 & percollege <= 10) |
         (percbelowpoverty <=20 & percollege >= 40),
       "Yes",
       "No"
     )
     )|>
  select(county, state,
         percbelowpoverty,
         percollege,
         potential_outlier)|>
  arrange(potential_outlier)
```

```
# A tibble: 437 x 5
   county    state percbelowpoverty percollege potential_outlier
   <chr>     <chr>            <dbl>      <dbl> <chr>            
 1 ADAMS     IL               13.2        19.6 No               
 2 ALEXANDER IL               32.2        11.2 No               
 3 BOND      IL               12.1        17.0 No               
 4 BOONE     IL                7.21       17.3 No               
 5 BROWN     IL               13.5        14.5 No               
 6 BUREAU    IL               10.4        18.9 No               
 7 CALHOUN   IL               15.1        11.9 No               
 8 CARROLL   IL               11.7        16.2 No               
 9 CASS      IL               13.9        14.1 No               
10 CHRISTIAN IL               11.7        13.6 No               
# i 427 more rows
```

```r
midwest |>
   mutate(
     potential_outlier = if_else(
       (percbelowpoverty >= 40 & percollege <= 10) |
         (percbelowpoverty <=20 & percollege >= 40),
       "Yes",
       "No"
     )
     )|>
ggplot(aes(x=percollege, y=percbelowpoverty, colour = potential_outlier, shape = state)) +
geom_point() +
  labs(x= "Population that is college educated (%)",
    y= "Population below the poverty line (%)",
    colour = "Potential Outlier",
    shape = "The state the county is in",
    title= "Percent College education vs Percent Below the Poverty Line \nby County")
```



Question 7

```
state_population <- midwest |>
  group_by(state) |>
  summarize(total_population =sum(poptotal))|>
  arrange(desc(total_population))
state_population
```

```
# A tibble: 5 x 2
  state total_population
  <chr>            <int>
1 IL            11430602
2 OH            10847115
3 MI             9295297
4 IN             5544159
5 WI             4891769
```

```
state_population |>
  mutate(
    population_prop = total_population / sum(total_population)
  ) |>
  arrange(desc(population_prop))
```

```
# A tibble: 5 x 3
  state total_population population_prop
  <chr>            <int>           <dbl>
1 IL            11430602           0.272
2 OH            10847115           0.258
3 MI             9295297           0.221
4 IN             5544159           0.132
5 WI             4891769           0.116
```

Comment: Illinois has the largest population, with approximately 27% of people in the Midwest living there. Wisconsin has the smallest population with approximately 12% of the population living there.

Question 8

```
state_poverty <- midwest |>
  group_by(state) |>
  summarize(mean_percbelowpoverty = mean(percbelowpoverty))

state_poverty
```

```
# A tibble: 5 x 2
  state mean_percbelowpoverty
  <chr>                 <dbl>
1 IL                     13.1
2 IN                     10.3
3 MI                     14.2
4 OH                     13.0
5 WI                     11.9
```

```
state_poverty |>
  arrange(mean_percbelowpoverty)
```

```
# A tibble: 5 x 2
  state mean_percbelowpoverty
  <chr>                 <dbl>
1 IN                     10.3
2 WI                     11.9
3 OH                     13.0
4 IL                     13.1
5 MI                     14.2
```

Comment: The state with the lowest below poverty percentage is Indiana at approximately 10% and the state with the highest below poverty percentage is Michigan.

Part 2

Question 9

```
df <- tibble(
  var_1 = c(10, 20, 30, 40, 50),
  var_2 = c("Pizza", "Burger", "Pizza", "Pizza", "Burger"),
  var_3 = c("Apple", "Apple", "Pear", "Pear", "Banana")
)

df
```

```
# A tibble: 5 x 3
  var_1 var_2  var_3
  <dbl> <chr>  <chr>
1    10 Pizza  Apple
2    20 Burger Apple
3    30 Pizza  Pear
4    40 Pizza  Pear
5    50 Burger Banana
```

```
df |>
  arrange(var_2)
```

```
# A tibble: 5 x 3
  var_1 var_2  var_3
  <dbl> <chr>  <chr>
1    20 Burger Apple
2    50 Burger Banana
3    10 Pizza  Apple
4    30 Pizza  Pear
5    40 Pizza  Pear
```

Comment: It sorts the rows of the table in alphabetical order according to variable 2.

```
df |>
  group_by(var_2)
```

```
# A tibble: 5 x 3
# Groups:   var_2 [2]
  var_1 var_2  var_3
  <dbl> <chr>  <chr>
1    10 Pizza  Apple
2    20 Burger Apple
3    30 Pizza  Pear
4    40 Pizza  Pear
5    50 Burger Banana
```

Comment: This groups data by variable 2, this is not reflected in the tibble but would matter if you were to try to do something else with the data, like mutate it or summarize it. It is different than arrange in the way that it does not change the order of the rows.

```
df |>
  group_by(var_2) |>
  summarize(mean_var_1 = mean(var_1))
```

```
# A tibble: 2 x 2
  var_2  mean_var_1
  <chr>       <dbl>
1 Burger       35
2 Pizza        26.7
```

Comment: This groups it by variable 2 and then calculates the mean of variable 1 for each group. Now the tibble shows only 2 rows of variable 2 because we used the groups.

```
df |>
  group_by(var_2, var_3) |>
  summarize(mean_var_1 = mean(var_1))
```

```
`summarise()` has grouped output by 'var_2'. You can override using the
`.groups` argument.
```

```
# A tibble: 4 x 3
# Groups:   var_2 [2]
  var_2  var_3  mean_var_1
  <chr>  <chr>       <dbl>
1 Burger Apple          20
2 Burger Banana         50
3 Pizza  Apple          10
4 Pizza  Pear           35
```

Comment: Now the tibble is grouped by both variable 2 and variable 3, so it calculates the mean of variable 1 for each combination of variable 2 and variable 3. The message is saying that you can use the .groups argument to change the way the output is grouped.

```
df |>
  group_by(var_2, var_3) |>
  summarize(mean_var_1 = mean(var_1), .groups = "drop")
```

```
# A tibble: 4 x 3
  var_2  var_3  mean_var_1
  <chr>  <chr>       <dbl>
1 Burger Apple          20
2 Burger Banana         50
3 Pizza  Apple          10
4 Pizza  Pear           35
```

Comment: This code makes it so after the summarize is done the groups are "dropped" or removed, so any more code would apply to all of the data and not any groups. This is different from the code in d) which still has all the data grouped after.

```
df |>
  group_by(var_2, var_3) |>
  summarize(mean_var_1 = mean(var_1), .groups = "drop")
```

```
# A tibble: 4 x 3
  var_2  var_3  mean_var_1
  <chr>  <chr>       <dbl>
1 Burger Apple          20
2 Burger Banana         50
3 Pizza  Apple          10
4 Pizza  Pear           35
```

```
df |>
  group_by(var_2, var_3) |>
  mutate(mean_var_1 = mean(var_1))
```

```
# A tibble: 5 x 4
# Groups:   var_2, var_3 [4]
  var_1 var_2  var_3  mean_var_1
  <dbl> <chr>  <chr>       <dbl>
```

```
1    10 Pizza  Apple          10
2    20 Burger Apple          20
3    30 Pizza  Pear           35
4    40 Pizza  Pear           35
5    50 Burger Banana         50
```

Comment: The code with summarize makes it so there is only one row per group and the mutate code makes it so there are still all the original rows.