DS002R - HW 3 - Wrangling

due Tuesday, Sep 24, 2024

your name here

Part 1

Back to the Midwest!

In this part you will revisit and build on some of your findings from HW 2, where you explored the `midwest` data frame. Remember that this data frame is bundled with the **ggplot2** package and is automatically loaded when you load the tidyverse package. As a refresher, the data contains demographic characteristics of counties in the Midwest region of the United States. You can read documentation for the data set, including variable definitions by typing `?midwest` in the Console or searching for `midwest` in the Help pane.

> ℹ Note
>
> The data in the `midwest` data frame are from the 2000 census, so the information you compute below is likely slightly different from the values today.

Question 1

Calculate the number of counties in each state and display your results in descending order of number of counties. Which state has the highest number of counties, and how many? Which state has the lowest number, and how many?

Question 2

Within a state, two counties can't have the same name, but across states county names can be shared. A friend says "Look, there is a county called XYZ in EVERY state in this dataset!" In a single pipeline, discover all counties that could fill in the value of XYZ. Your output should be a data frame with two columns: county and the number of times they appear in the data.

Tip

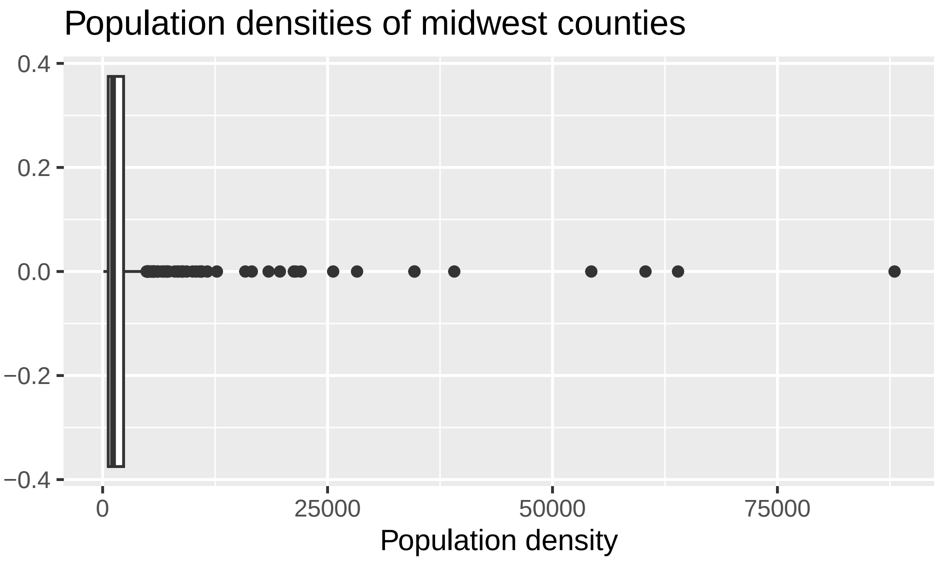
You will want to use the `filter()` function in your answer, which requires a logical condition to describe what you want to filter for. For example `filter(x > 2)` means filter for values of `x` greater than 2, `filter(y <= 3)` means filter for values of y less than or equal to 3.

operator	definition
`<`	less than
`<=`	less than or equal to
`>`	greater than
`>=`	greater than or equal to
`==`	exactly equal to
`!=`	not equal to
`x & y`	`x` AND `y`
`x | y`	`x` OR `y`
`is.na(x)`	test if `x` is `NA`
`!is.na(x)`	test if `x` is not `NA`
`x %in% y`	test if `x` is in `y`
`!(x %in% y)`	test if `x` is not in `y`
`!x`	not `x`

The table above is a summary of logical operators and how to articulate them in R.

Question 3

Consider the following box plot of population densities where you were can see some counties have extreme values.



Identify the counties described in each part:

a. The counties with a population density higher than 25,000. Your code must use the `filter()` function.

b. The county with the highest population density. Your code must use the `max()` function.

> ℹ Note
>
> Answer using a **single** data wrangling pipeline for each part. Your response should be a data frame with five columns: county name, state name, population density, total population, and area, in this order. If your response has multiple rows, the data frame should be arranged in descending order of population density.

Question 4

Let's say that you want to describe the distribution of population densities. The following is one acceptable description (in words) that touches on shape, center, and spread of this distribution. Create a plot that fits the description, and calculate the values that should go into the blanks.

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

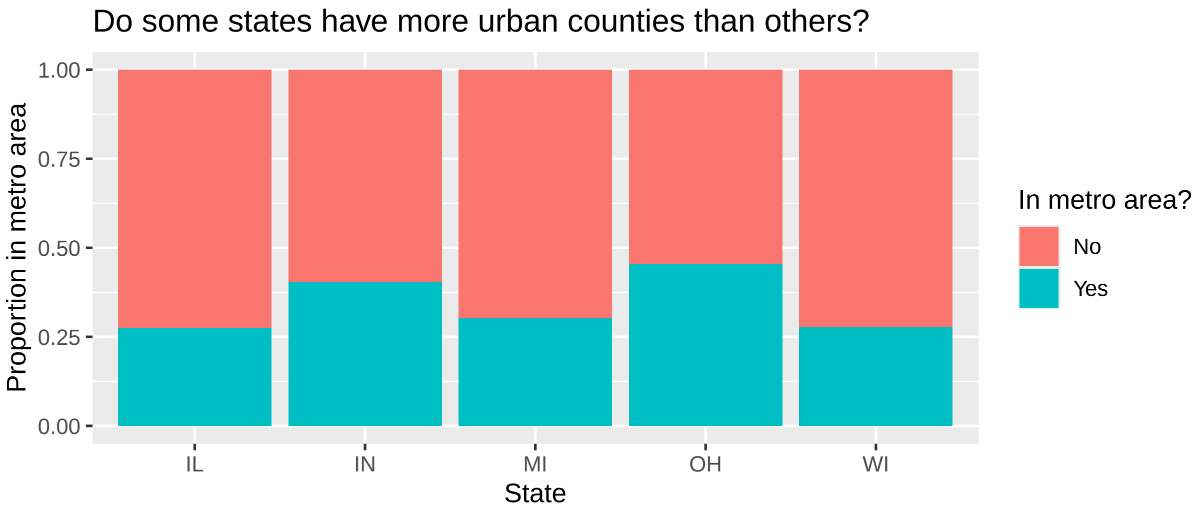
Tip

Think about which measures of center and spread are appropriate for skewed distributions. That is, there is a right answer for the choice of functions you use to calculate the center and spread.

Question 5

Recall the visualization from HW 2 that showed the proportion of urban counties in each state.

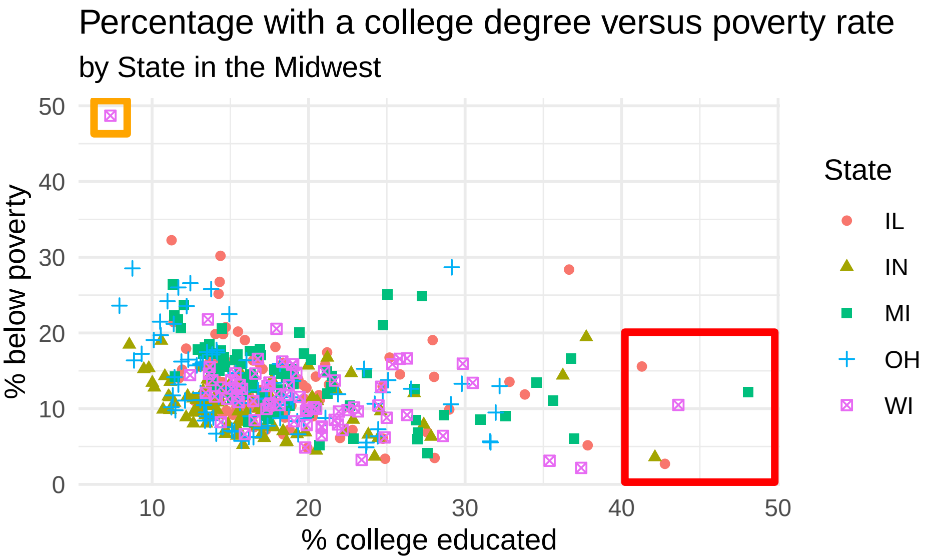
```r
midwest <- midwest |>
  mutate(metro = if_else(inmetro == 1, "Yes", "No"))

ggplot(midwest, aes(x = state, fill = metro)) +
  geom_bar(position = "fill") +
  labs(
    title = "Do some states have more urban counties than others?",
    x = "State",
    y = "Proportion in metro area",
    fill = "In metro area?"
  )
```



In a single data pipeline, calculate the proportion of residents in a metro area for each state.

Question 6

Return to the following scatter plot of percentage below poverty vs. percentage of people with a college degree, where the color and shape of points are determined by `state`. Recall that you were asked to identify (by name) at least one county that is a clear outlier.



a. In a single pipeline, identify the observations marked in the orange square on the upper left corner. Your answer should be a data frame with four variables: county, state, percentage below poverty, and percentage college educated.

b. In a single pipeline, identify the observations marked in the red square in the plot above. Your answer should again be a data frame with four variables: county, state, percentage below poverty, and percentage college educated.

c. Bring your answers from part (a) and part (b) together! In a single pipeline, and a single `filter()` statement, identify the observations marked in the red and orange square in the plot above. Your answer should again be a data frame with four variables: county, state, percentage below poverty, and percentage college educated.

d. Create a new variable in `midwest` called `potential_outlier`. This variable should take on the value:

- `Yes` if the point is one the ones you identified in part (c), i.e., one of the points marked in the squares in the plot above.
- `No` otherwise.

Then, display the updated `midwest` data frame, with county, state, percentage below poverty, percentage college educated, `potential_outlier` as the selected variables, arranged in ascending order of `potential_outlier`. (Hint: look above and/or recall how `metro` was calculated using the function `if_else()`.)

e. Recreate the visualization above, i.e. a scatterplot of percentage below poverty vs. percentage of people with a college degree, however color the points by the newly created `potential_outlier` variable instead of state.

Question 7

a. In a single pipeline, calculate the total population for each state and save the resulting data frame as `state_population` and display it in descending order of total population.
b. Then, in a separate pipeline, calculate the proportion of the total population in each state (e.g., find the percent of people living in WI out of all the people in the midwest) and, once again, display the results in descending order of proportion of population.

> Tip
>
> In answering parts (a) and (b), you'll create two new variables, one for total population and other for proportion of total proportion. Make sure to give them "reasonable" names – short but evocative.

c. Which Midwestern state is most populous and what percent of the Midwest population lives there? Which is the least populous and what percent lives there?

Question 8

Calculate the average percentage below poverty for each state and save the resulting data frame as `state_poverty` with the columns `state` and `mean_percbelowpoverty`.

Then, in a new pipeline, display the `state_poverty` data frame in ascending order of `mean_percbelowpoverty`. Which state has the lowest average percentage below poverty across its counties? Which state has the highest average percentage below poverty across its counties?

Part 2

Poor nameless kitties in Seattle

Use the `seattlepets` dataset from the **openintro** R package to do some wrangling:

Question 9

a. How many pets are included in the dataset? (Print the answer to the screen, show the R code which is your work, and write a complete sentence with the answer.)

b. How many variables are there for each pet? What are the names of the variables? Again, show your work using **R code** (not the Viewer or the Environment) and write a complete sentence.

c. What are the three most common pet names in Seattle? (You'll need to use the function `n()` which counts the number of rows.)

Question 10

a. What are the three most common names for each of the cat and dog species? Your initial code may only tell you about dogs (and the poor unnamed kitties). The `slice_` family of functions pulls out a specified number of rows. For example, `slice_min()` pulls out the smallest rows, `slice_max()` pulls out the largest rows, `slice_head()` pulls out the first row, … (see the cheatsheets! https://www.rstudio.com/resources/cheatsheets/).

b. I've added a new column to the dataset which gives the proportion of a particular species with the given name. Create a scatterplot of the 20 most popular pet names (as measured by the max proportion of the species with that name - the value calculated below). The x-axis will represent the proportion of cats with that name, the y-axis will represent the proportion of dogs with that name.

```
seattlepets_w_prop <- seattlepets |>
  group_by(species, animal_name) |>
  summarize(n_names = n()) |>
  mutate(prop_names = n_names / sum(n_names)) |>
  ungroup()

head(seattlepets_w_prop)
```

```
# A tibble: 6 x 4
  species animal_name     n_names prop_names
  <chr>   <chr>             <int>      <dbl>
1 Cat     "\"Mama\" Maya"       1  0.0000578
2 Cat     "\"Mo\""              1  0.0000578
3 Cat     "'Alani"              1  0.0000578
4 Cat     "-"                   1  0.0000578
5 Cat     "1"                   1  0.0000578
6 Cat     "2"                   1  0.0000578
```

Hint 1: you'll need to `pivot_` (wider or longer?)
Hint 2: after pivoting, you'll need to sort based on the proportion. But you have two columns of proportions! Sort on the maximum of the two columns. In order to do a piece-wise maximum (element by element) in your `mutate()` call, use the function `pmax(first column, second column, na.rm = TRUE)`.
Hint3: after you get the basic scatterplot made, clean it up in the following ways:

- add pet name labels using `geom_text()` [Or better, use `geom_text_repel()` in **ggrepel**]
- add the line y = x using `geom_abline()`
- make the x-axis label something better
- remove the y-axis label and use the title to provide the y-axis (so that the letters are written horizontally instead of vertically)
- remove the poor kitties that don't have a name