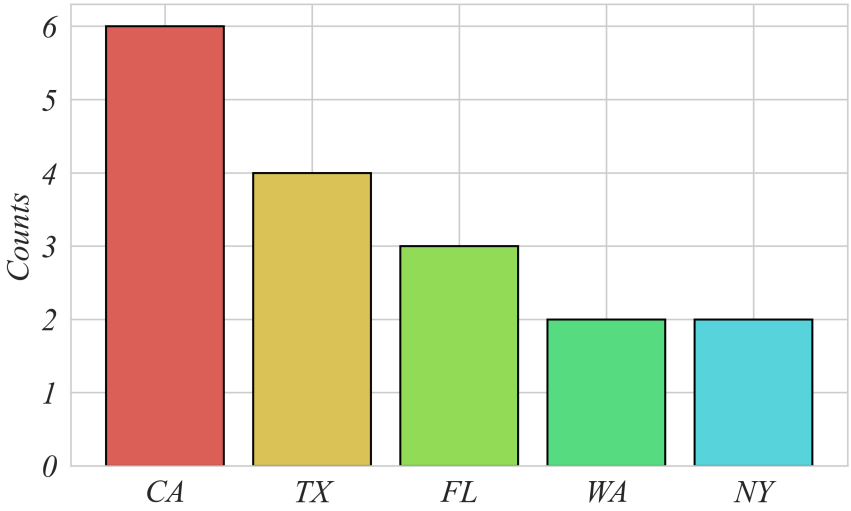
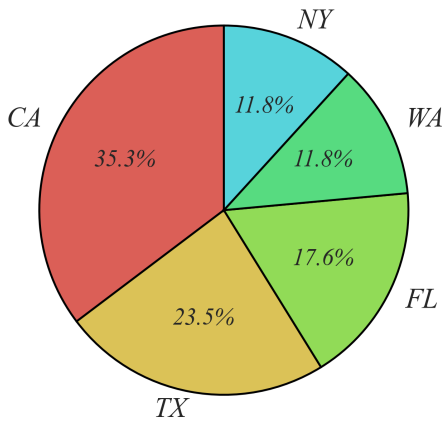
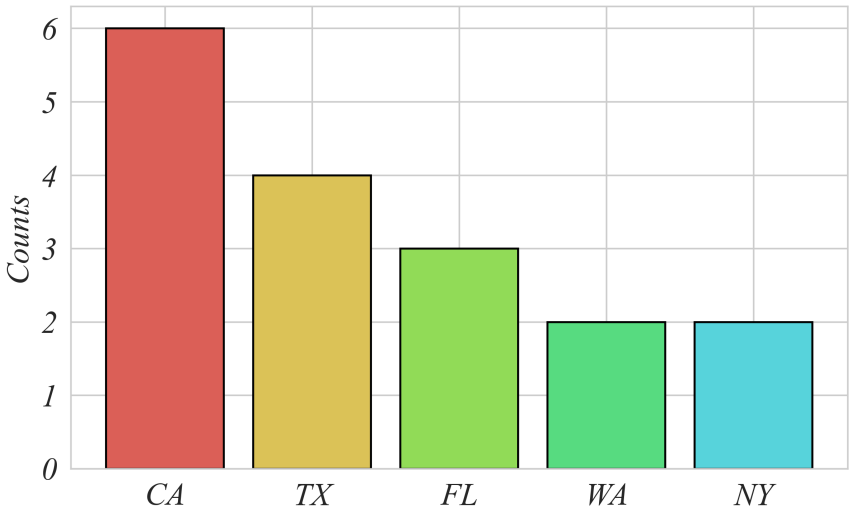
Part 1.1 | Visualizing Categorical Variables

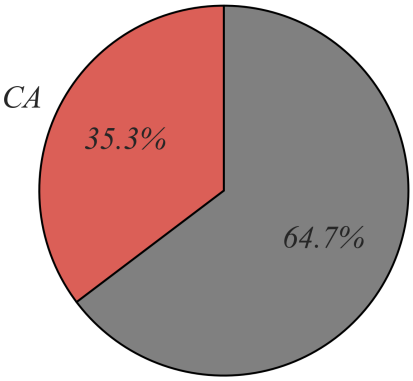
Choosing the right visualization is key for understanding and communicating data effectively. Let's say you are a data analyst advising a small coffee chain on where to start selling a new product. You can find the dataset: Coffee_Shops.csv. This dataset contains a **categorical variable** which indicates the state the shop operates in. Here are two visualizations of the number of chain locations across a few states: **bar chart** and a **pie chart**.





Which state has the most shops? It's easy to see from either chart that California (CA) has the most cafes, but not every comparison is this straightforward. For example, we might want to know whether Florida (FL) or Washington (WA) has more shops. In this case, the bar chart makes it much easier to see that FL has more shops than WA. But if we're trying to compare the share of shops are in CA, a pie chart might work best.





When presenting data, the best choice of chart depends on the comparison you want your audience to make.

Summary

- Use **bar charts** to compare values with each other.
- Use **pie charts** to compare one value against the total.

Excel Exercise

Lets make some similar visualizations of the Coffee_Shops.csv dataset in Excel. The .csv file-type is a universal format which stands for "comma-separated values" and is one of the most used data formats. Open the file in Excel. Excel will likely show you a suggestion to convert the file to an Excel-specific format, xlsx. When working with Excel, it's often helpful to keep the csv file as your starting file and create a second file in the xlsx format. You can do this either by clicking on the notification bar or by going to Home and save as. You'll be propted to select the file format xlsx. Save as Coffee_Shops.xlsx.

The data is a single column with the title STATE and entries representing the state where the coffee shop is located. Since the data is categorical, before we can do either a bar chart or a pie chart, we need to summarize the frequencies of shops by state. We'll start by getting a list of all states in the sample using Excel's UNIQUE command. Pick a cell (eg. C5) to start a summary table with the column header "STATES". Then we can enter the following code into the cell below (eg. C6).

```
=UNIQUE(A2:A18)
```

This tells Excel to list out all the unique values contained in the data range between cell A2 and A18. Because we've entered this below the column header "STATES", this will create a nice column of all the unique states with coffee shop locations.

Next, we're going to count the number of coffee shops in each state. We'll do this with Excel's COUNTIF command. Start a new column next to "STATES" (eg. D5) and label it something like "SHOPS". Then in the cell below, use the COUNTIF command, using the data range and the state contained in the neighboring cell. With the example cell labels so far, enter the following in the cell below "SHOPS" (eg. D6):

```
=COUNTIF(A2:A18,C6)
```

This tells Excel to look at all the entries in the data range A2 to A18 and count the number of times the value in the cell C6 appears. In this example, earlier we constructed the cell C6 to contain one of the unique entries in the data range. Specifically, in this example it will contain "TX". This means the cell we just made (eg. D6) will tell us the number of coffee shops located in Texas (TX).

Finally, we want to use this command for all of the states in the list. We can do this in two ways. We should go through and write out each command for each row in the list of states. For example, the next cell could look like the following:

```
=COUNTIF(A2:A18,C7)
```

With a short list like this, it would be easy to do it manually like this. But sometimes lists are long and we might want to copy and paste the commands. The way the command is written, however, if we copy and past, it will move both the data range and the target text down the spreadsheet by one cell, giving the following incorrect command:

```
=COUNTIF(A3:A19,C7)
```

This misses the first entry in our data range. While in this case doesn't turn out to impact our numbers, it easily could. We can fix this problem by adding the "$" symbol to cell letters numbers we do not wish Excel to change when we copy and paste. So in the first cell in the "SHOPS" column (eg. D6), enter the following command:

```
=COUNTIF($A$2:$A$18,C6)
```

First, we'll make a bar chart with this frequency data. There are a couple ways to go about doing this. One way is to highlight the frequency data (including the column titles), go into the Insert tab, click on the bar chart button, and select a 2-d chart. This should produce a bar chart with the title "SHOPS" and bars with labels that correspond to their states. This is nice, but I think the figure looks nicer by reducing the clutter of horizontal grid lines. Simply click on the thing you'd like to remove and then hit delete. You can even rename the figure something like "Coffee Shop Locations" if you wish.

Second, we'll create a pie chart to highlight the share of coffee shops located in CA. To do this, we'll create another table with two rows right below our first frequency table. The first row will contain "CA" in a "STATE" column and a reference to the number of shops in the "SHOPS" column. Then in the second row, we'll count the number of total shops and subtract off the number of shops located in CA using the row above (eg. D13).

```
=COUNTIF(A2:A18,"*") – D13
```

The "*" in the COUNTIF command simply tells Excel to count all the text entries in the data range. Then we subtract off the number of shops located in CA, which is held in cell D13 in this example.

Then we can plot this data in a pie chart. Highlight the new frequency table and the column headers, go to the Insert tab, and click on 2-d pie chart. This produces a reasonable pie chart, but you can click on any element to modify it as you'd like.