

FREQUENCY DISTRIBUTION

The background features two large, overlapping geometric shapes. On the left, a light teal triangle points downwards towards the center. On the right, a dark teal triangle points upwards towards the center. These two triangles meet at a point directly below the text 'FREQUENCY DISTRIBUTION', creating a symmetrical, hourglass-like negative space.

WHAT IS FREQUENCY DISTRIBUTION?

FREQUENCY DISTRIBUTION

A **frequency** of a value is the number of times it occurs in a dataset. A **frequency distribution** is the number of times each variable occurs in a dataset.

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- **Relative frequency distribution**: the proportion of each value or class interval of a variable. Useful for any type of data **if we care about comparing frequencies** rather than amounts.
- **Cumulative frequency distribution**: the sum of frequencies less than or equal to each value or class interval of a variable. Useful when we want to understand how often observations fall below certain values.

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 - **Discrete data** represents counts of individual items like number of students in a class.
 - **Continuous data** represents measurements of uncountable values like density, volume or time.

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 - **Binary data** represents yes or no outcomes like coin flips or win/loss situations.
 - **Nominal data** represents groups without rank or order between them – like the names of species or colours.
 - **Ordinal data** represents groups that are ranked – like finishing place in a race.

UNGROUPED FREQUENCY DATA – TABLE

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 - For **ordinal** variables, the values should be ordered from smallest to largest.
 - For **nominal** variables, the rows can be ordered arbitrarily.
2. Count the **frequencies**.

UNGROUPED FREQUENCY DATA – EXAMPLE 1

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UNGROUPED FREQUENCY DATA – EXAMPLE 1

A gardener sets up a bird feeder in his backyard. He wishes to know which type of bird species visit the feeder the most. His observations are in the following table:

| Species | Frequency |
|-----------|-----------|
| Chickadee | 3 |
| Dove | 1 |
| Finch | 4 |
| Grackle | 2 |
| Sparrow | 4 |
| Starling | 2 |

UNGROUPED FREQUENCY DATA – EXAMPLE 2

We observe how many times a specific type of tram (based on age) stops at a chosen station each day.



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This experiment may yield a table like this:

| Type | Frequency |
|------|-----------|
| 1990 | 6 |
| 1996 | 11 |
| 2005 | 3 |
| 2017 | 5 |

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 - Calculate the **range** = highest value – lowest value.
 - Decide on the **class interval width**. **ALWAYS THINK** about that the best width should be! But, if you can't decide, a rule of thumb is the width

$$\text{width} = \frac{\text{range}}{\sqrt{\text{number of inputs}}}.$$

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- Calculate the **class intervals**. Each interval is of the form [lower limit, lower limit + width). Simply divide the outputs into these intervals.

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52, 34, 32, 29, 63, 40, 46, 54, 36, 36, 24, 19, 45, 20, 28, 29, 38, 33, 49, 37.

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52, 34, 32, 29, 63, 40, 46, 54, 36, 36, 24, 19, 45, 20, 28, 29, 38, 33, 49, 37.

We calculate the range as highest – lowest = $63 - 19 = 44$.

We calculate the interval width as

$$\text{width} = \frac{\text{range}}{\sqrt{\text{sample size}}} = \frac{44}{\sqrt{20}} = 9.84,$$

and round it up to 10.

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and round it up to 10.

Therefore, we have the following intervals

$[19, 29)$, $[29, 39)$, $[39, 49)$, $[49, 59)$, $[59, 69)$.

GROUPED FREQUENCY DATA – EXAMPLE

Counting the numbers of outputs falling into each of those intervals gives the table:

| Age | Frequency |
|---------|-----------|
| 19 – 28 | 4 |
| 29 – 38 | 9 |
| 39 – 48 | 3 |
| 49 – 58 | 3 |
| 59 – 68 | 1 |

RELATIVE FREQUENCY DATA – TABLE

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2. To each output add another column to represent **relative frequencies**.

RELATIVE FREQUENCY DATA – EXAMPLE

In our gardener example, the relative frequency table would look like this:

| Species | Frequency | Relative Frequency |
|-----------|-----------|--------------------------------|
| Chickadee | 3 | $\frac{3}{3+1+4+2+4+2} = 0.19$ |
| Dove | 1 | 0.06 |
| Finch | 4 | 0.25 |
| Grackle | 2 | 0.13 |
| Sparrow | 4 | 0.25 |
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CUMULATIVE FREQUENCY DATA – TABLE

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2. Add another column for each output with **cumulative frequency**. The cumulative frequency is the number of observations less than or equal to a certain value or class interval.

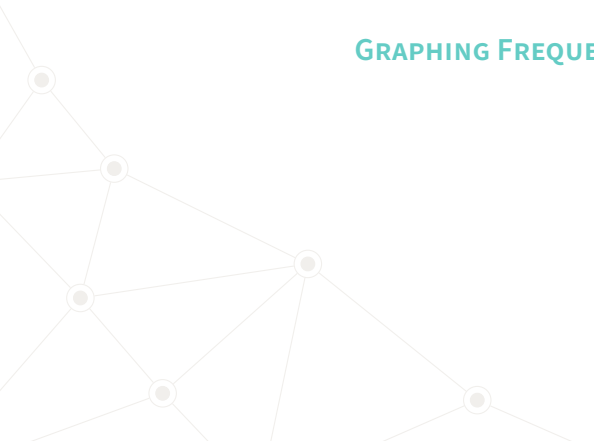
CUMULATIVE FREQUENCY DATA – EXAMPLE

Going back to our example of a sociological survey. The cumulative frequency table of the age of survey participants would look like this:

| Age | Frequency | Cumulative Frequency |
|---------|-----------|----------------------|
| 19 – 28 | 4 | 4 |
| 29 – 38 | 9 | $9 + 4 = 13$ |
| 39 – 48 | 3 | $9 + 4 + 3 = 16$ |
| 49 – 58 | 3 | 19 |
| 59 – 68 | 1 | 20 |

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GRAPHING FREQUENCY DISTRIBUTIONS



PIE CHARTS

Pie charts can be used to graph **relative** frequency distributions of **nominal variables**.



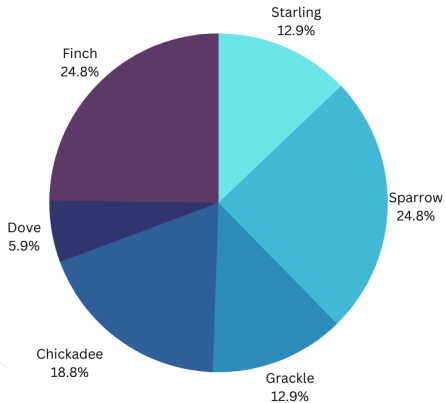
PIE CHARTS

Pie charts can be used to graph **relative** frequency distributions of **nominal variables**. In our gardener example, we had the following relative frequency table of bird species:

| Species | Frequency | Relative Frequency |
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| Chickadee | 3 | $\frac{3}{3+1+4+2+4+2} = 0.19$ |
| Dove | 1 | 0.06 |
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PIE CHARTS

This table can be organized into a pie chart like this:



BAR CHART

Bar charts can be used to visualize the **frequency** or **relative frequency** of **categorical data** (both **nominal** and **ordinal**).



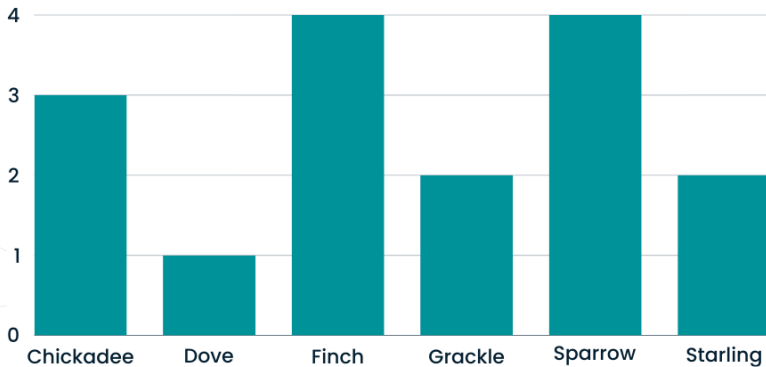
BAR CHART

Bar charts can be used to visualize the **frequency** or **relative frequency** of **categorical data** (both **nominal** and **ordinal**). The table of frequency distribution of bird species in our gardener example looked like this:

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BAR CHART

We can organize this data into a bar chart:



HISTOGRAM

A histogram looks similar to a bar chart and can be used to visualize the **frequency** or **relative frequency** of a **quantitative variable**.



HISTOGRAM

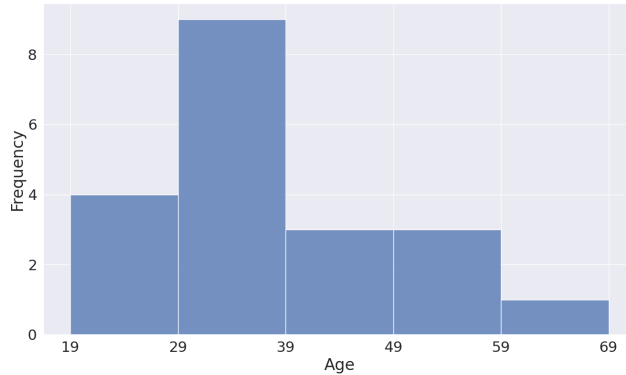
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Recall the table from our sociological survey example:

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HISTOGRAM

The values can be organized into the following histogram:



HISTOGRAM VS. BAR CHART

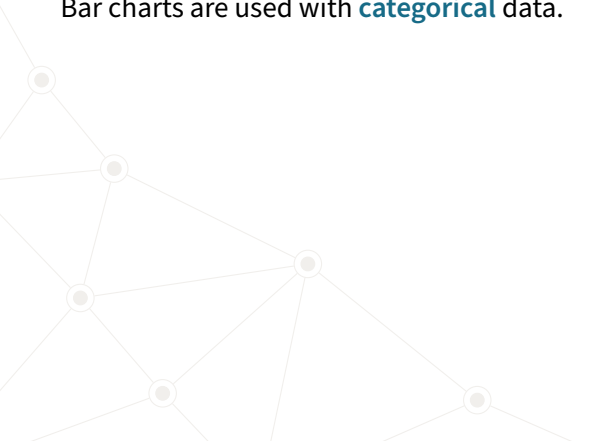
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Bar charts are used with **categorical** data.

| | Bar Chart | Histogram |
|-----------------|--------------------|----------------------------|
| Variable | Categorical | Quantitative |
| Grouping | Ungrouped (values) | Grouped (interval classes) |
| Order | Any | Lowest to highest |