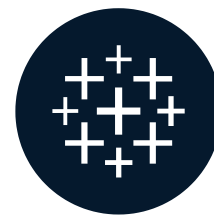


Measures of spread

STATISTICAL TECHNIQUES IN TABLEAU



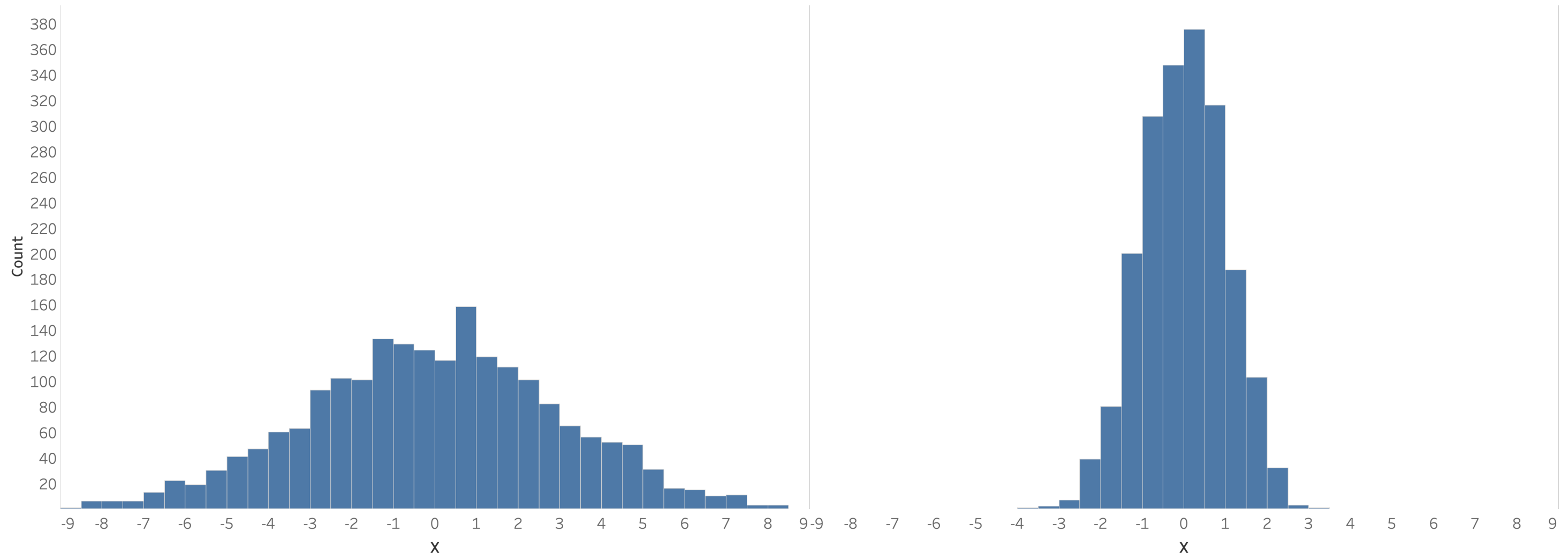
Maarten Van den Broeck

Content Developer at DataCamp

Statistics for describing a variable

Statistic	Description
Count	number of observations
Median	midpoint of your observations
Average	mean value of your observations
Min/Max	lowest and highest value
Quartile/IQR	25th and 75th percentile / spread of the 50% of your middlemost observations
Modality/Mode	number of modes / most occurring value
Skewness	(a)symmetry of the distribution
Kurtosis	distribution of extreme values

Measures of spread



- Spread is affected by kurtosis (outliers) and skewness (asymmetry)
- Typically, spread around the mean is only useful for normal distributions

Variance

$$x_i - \bar{x}$$

$$(x_i - \bar{x})^2$$

$$\sum (x_i - \bar{x})^2$$

$$\frac{\sum (x_i - \bar{x})^2}{n-1}$$

x_i = individual data point, \bar{x} = sample mean

n = number of observations

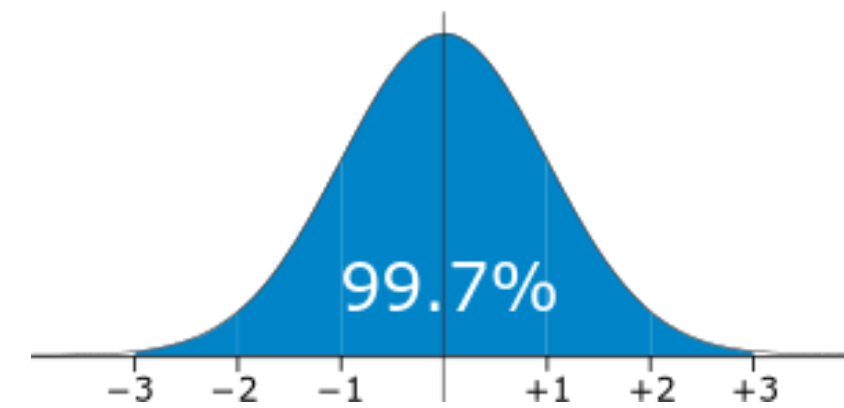
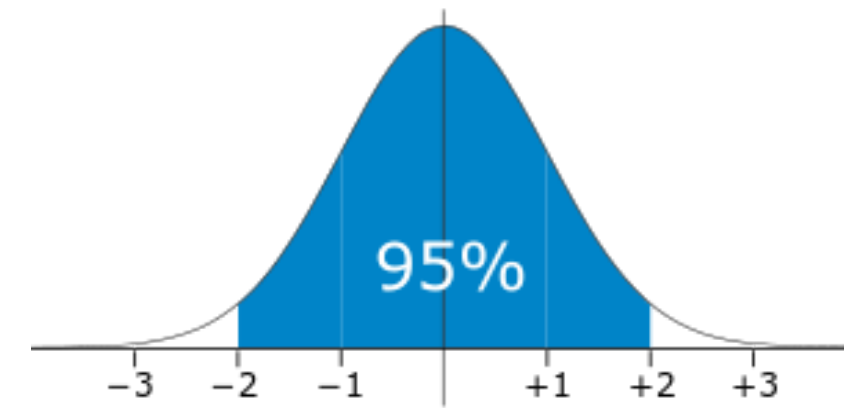
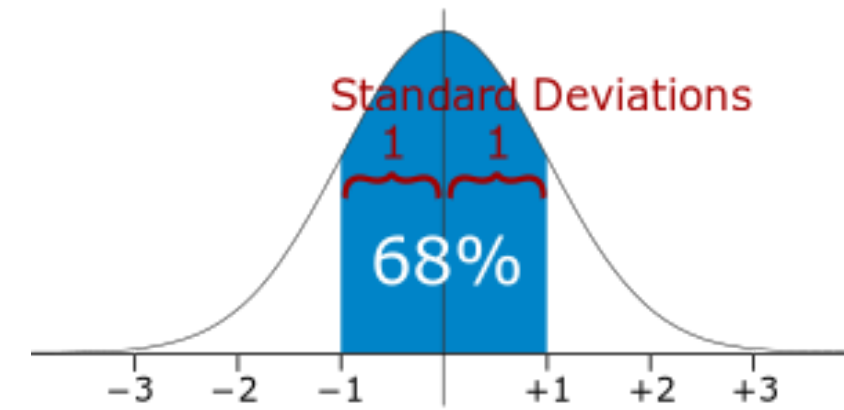
- Variance is the average of the squared differences from the mean
- Higher variance means higher spread of the data
- Unit of variance is squared

¹ Note: you don't need to memorize the formulas. They unveil the black box of Tableau's calculations.

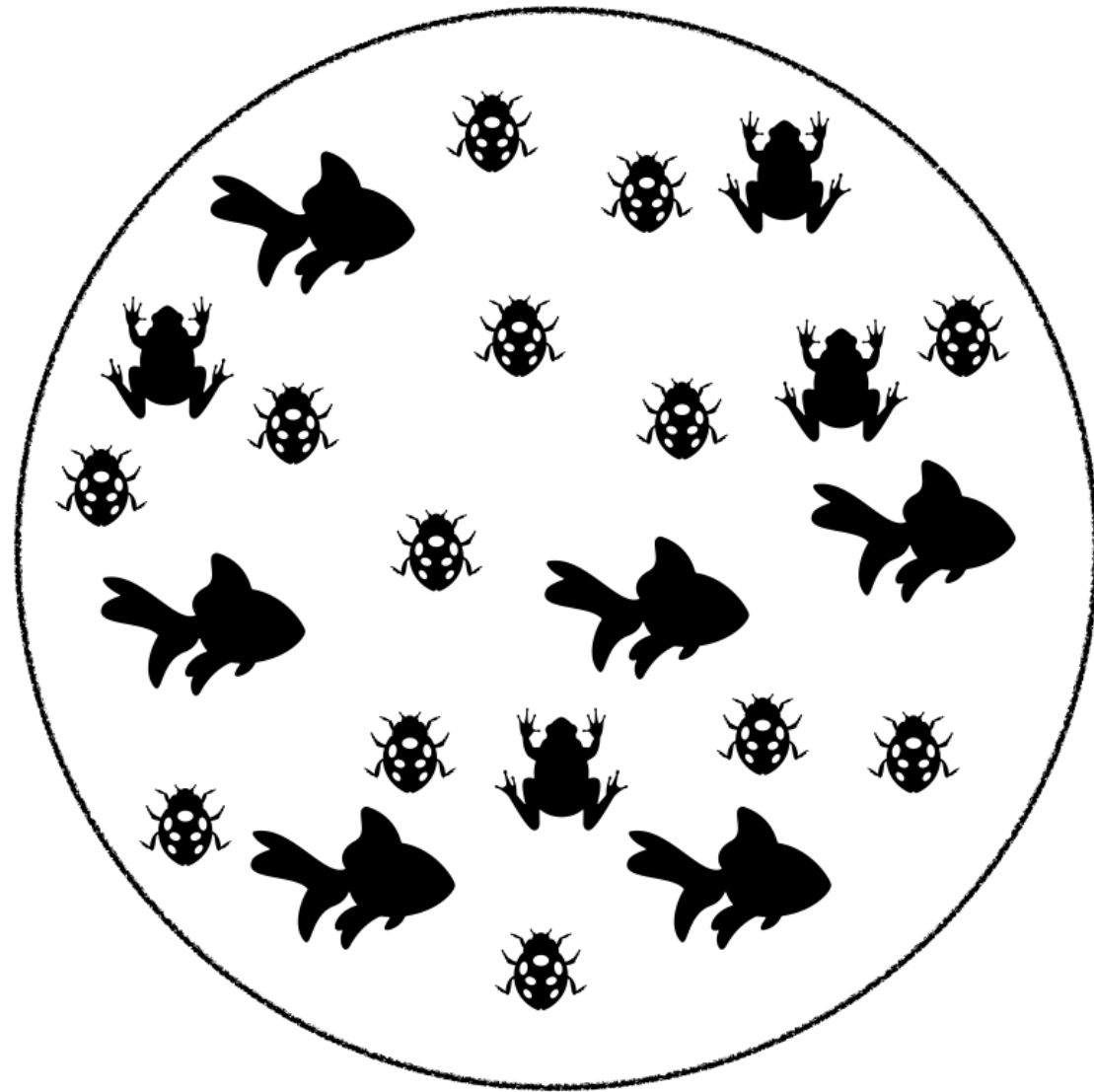
Standard deviation (SD or s)

$$s = \sqrt{\frac{\sum (x_i - \bar{x})^2}{n-1}} \text{ or } s = \sqrt{\text{variance}}$$

- Unit of standard deviation is same as the variable
- How far on average lie the data points from the mean
- 68% of the observations lies within $[-1s, 1s]$ range if data is normally distributed
- Number of standard deviations can be used as a threshold to pinpoint unusual values

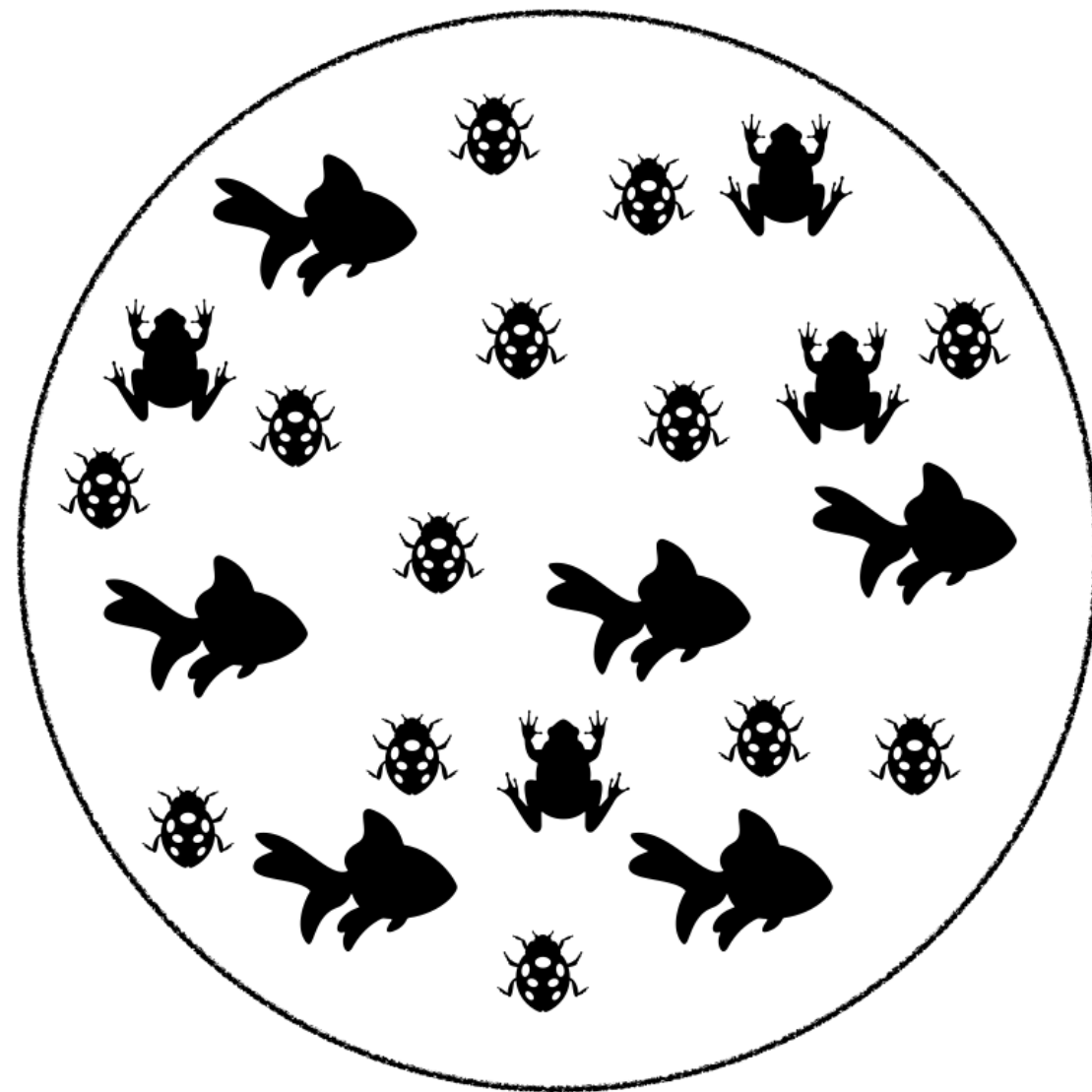


Population vs. sample

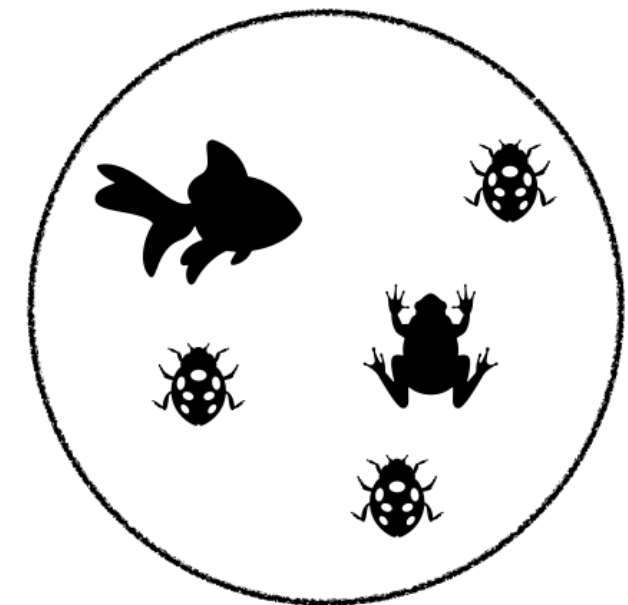


Population

Population vs. sample

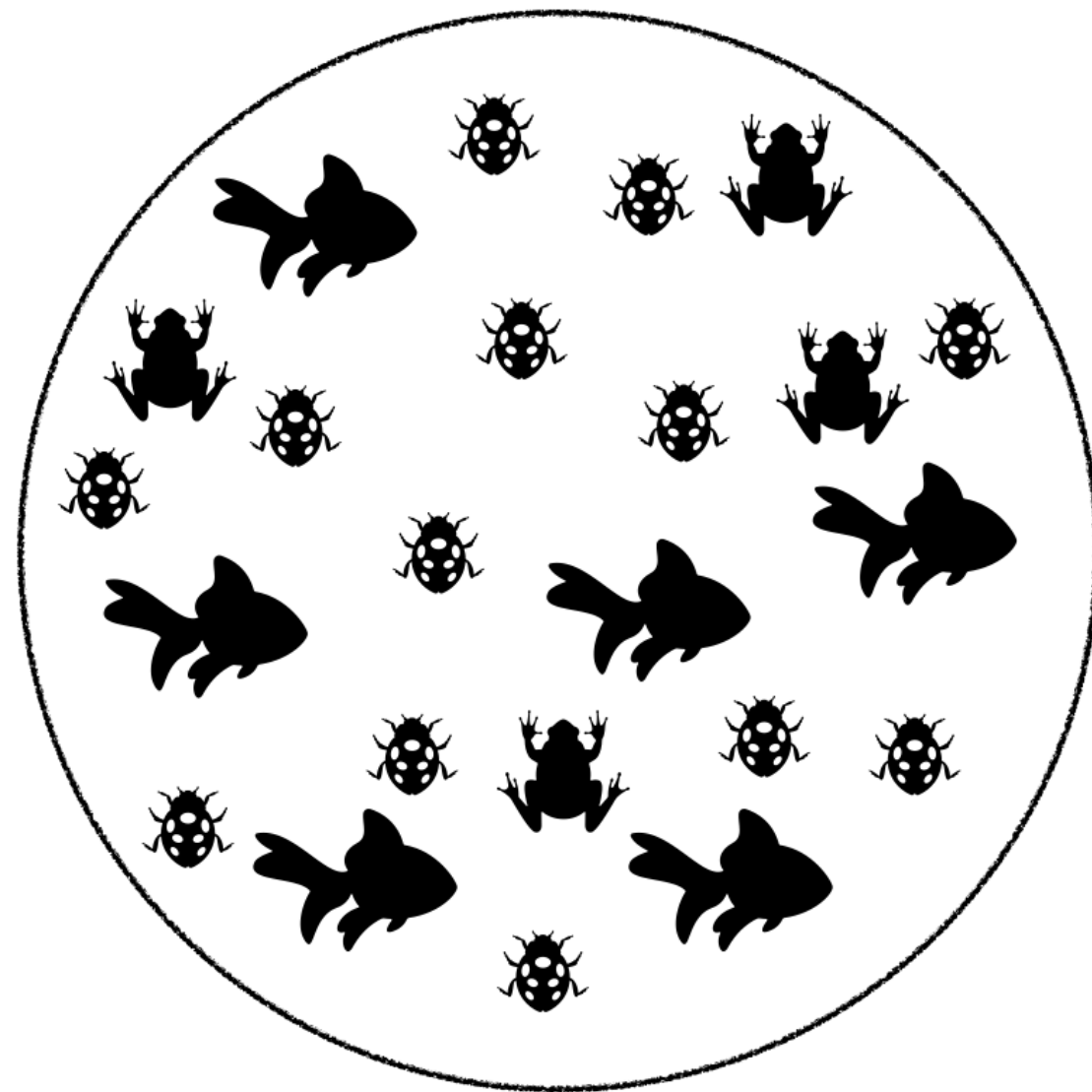


Population

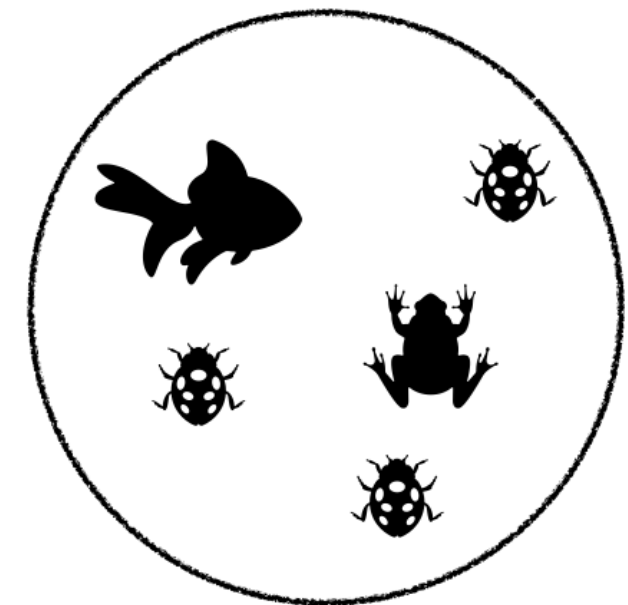
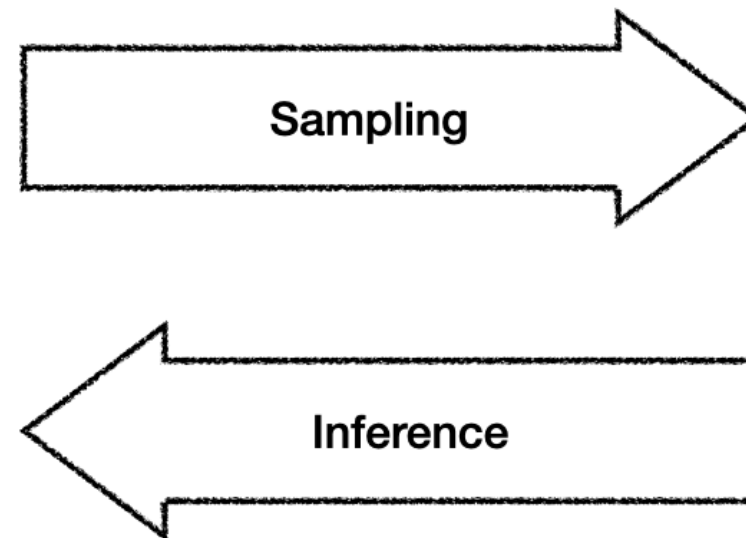


Sample

Population vs. sample



Population



Sample

Calculating spread in sample vs. population

Sample variance s^2

$$s^2 = \frac{\sum (x_i - \bar{x})^2}{n-1}$$

data per country (sample)

generalize for Europe (population)

Population variance σ

$$\sigma^2 = \frac{\sum (x_i - \mu)^2}{N}$$

data of your university (population)

no need for generalizing

Sample standard deviation s

$$s = \sqrt{\frac{\sum (x_i - \bar{x})^2}{n-1}}$$

\bar{x} = sample mean

n = sample size

Population standard deviation σ^2

$$\sigma = \sqrt{\frac{\sum (x_i - \mu)^2}{N}}$$

μ = population mean

N = population size

¹ Note: you don't need to memorize the formulas. They unveil the black box of Tableau's calculations.

Calculating spread in sample vs. population

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data per country (sample)

generalize for Europe (population)

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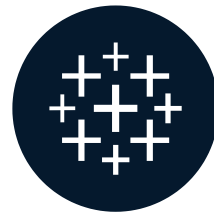
¹ Note: you don't need to memorize the formulas. They unveil the black box of Tableau's calculations.

Let's practice!

STATISTICAL TECHNIQUES IN TABLEAU

Tableau: summary cards and spread

STATISTICAL TECHNIQUES IN TABLEAU



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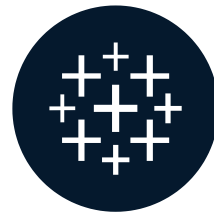
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STATISTICAL TECHNIQUES IN TABLEAU

Standard error and confidence intervals

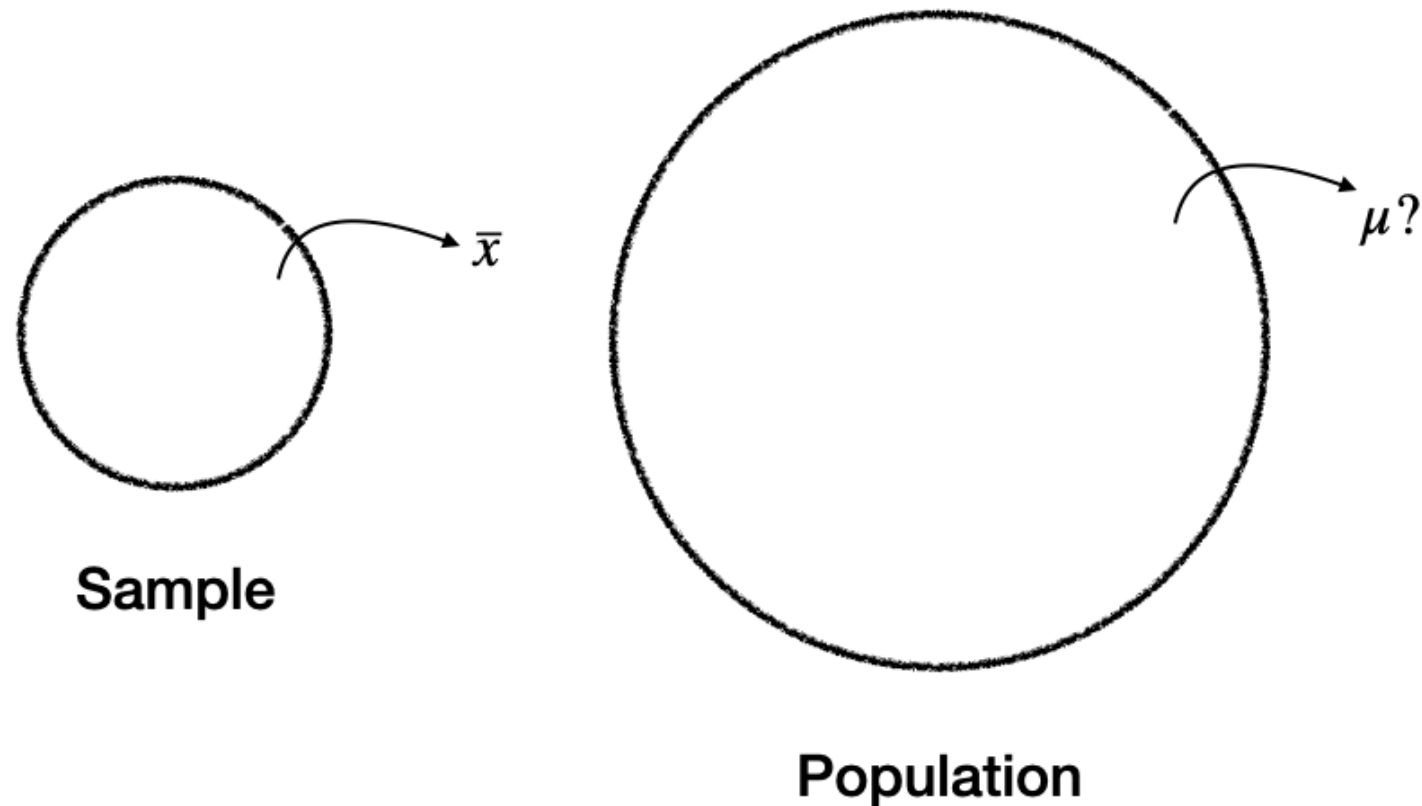
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The standard error (SE)

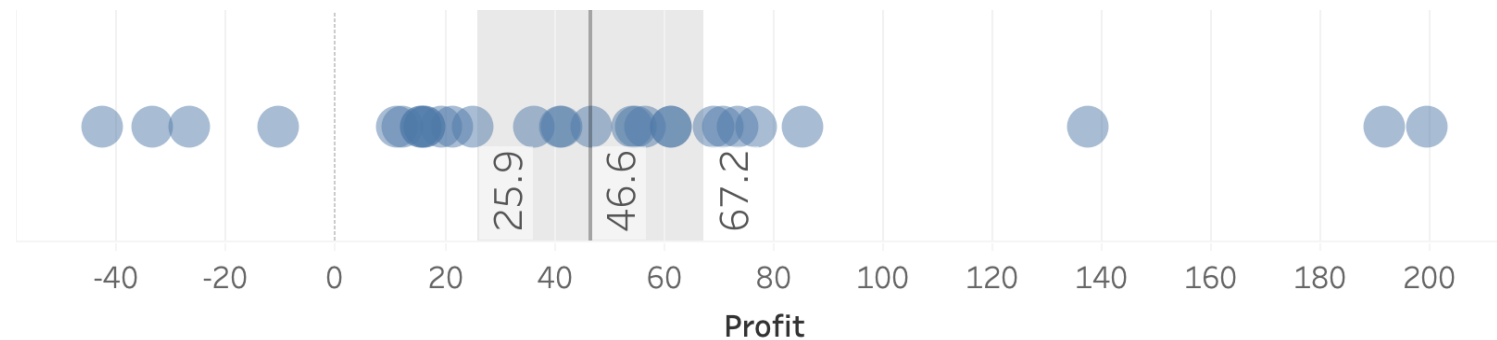


- $SE = \frac{SD}{\sqrt{n}}$ SD = standard deviation
 n = sample size
- Larger sample size means smaller SE

- Standard error of the mean: how much the sample mean and population mean deviate

The confidence interval (CI)

"I'm 95 percent confident that the true population mean lies within the ranges of my confidence interval."



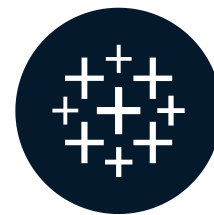
- When taking more samples, 95% of the confidence intervals will contain the true population mean
- Sample $n = 30$
 - Sample mean $\bar{x} = 46.6$
 - Lower bound = 25.9
 - Upper bound = 67.2
- Population mean = 44.4
- $CI = \bar{x} \pm level * SE$
- $level = 1.96$ for 95% CI

Let's practice!

STATISTICAL TECHNIQUES IN TABLEAU

Tableau: adding lines and distribution bands

STATISTICAL TECHNIQUES IN TABLEAU



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Let's practice!

STATISTICAL TECHNIQUES IN TABLEAU