

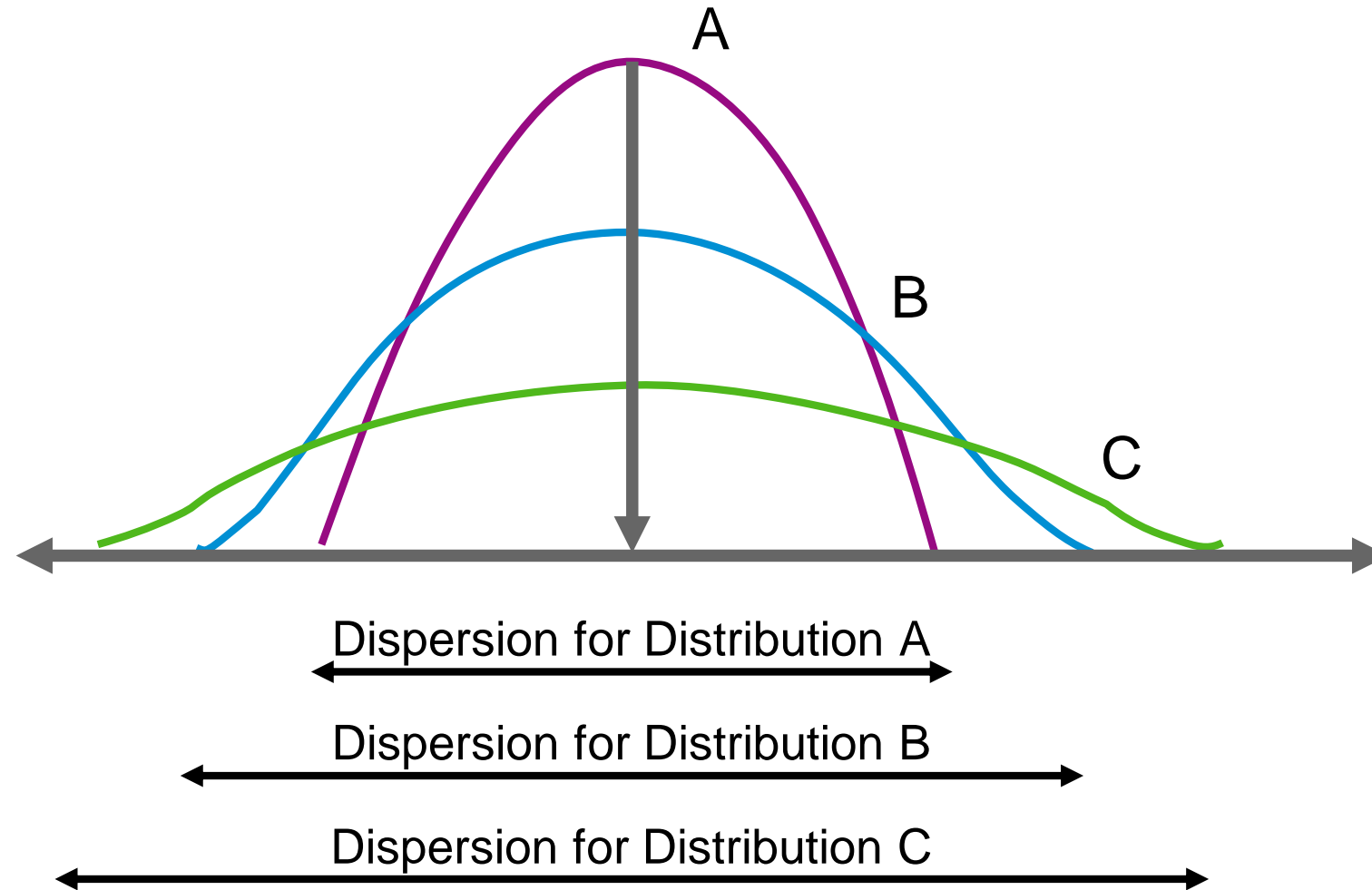


Week 2: Descriptive Statistics

## Unit 5: Measures of Dispersion

# Measures of Dispersion

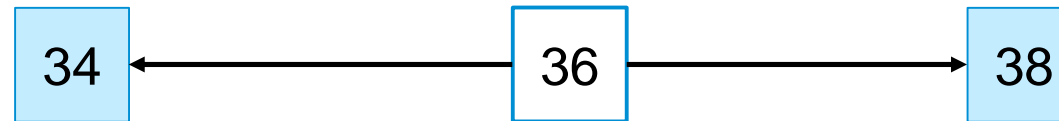
## Introduction



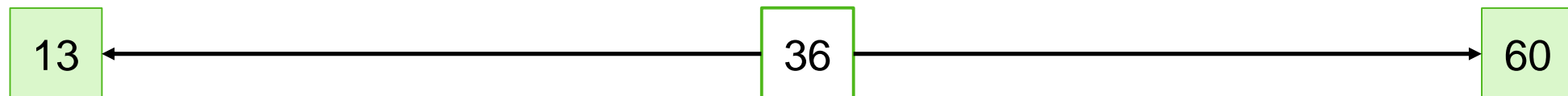
## Measures of Dispersion

### Measure of variation

Ages of Group A: 34, 35, 35, 37, 37, 38 → Average is 36 years

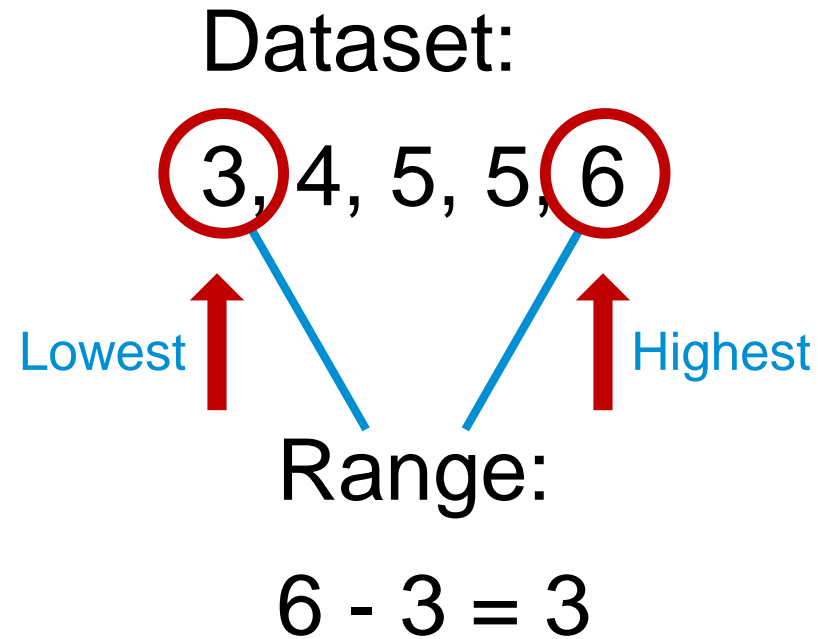


Ages of Group B: 13, 15, 17, 55, 56, 60 → Average is 36 years



## Measures of Dispersion

### Range

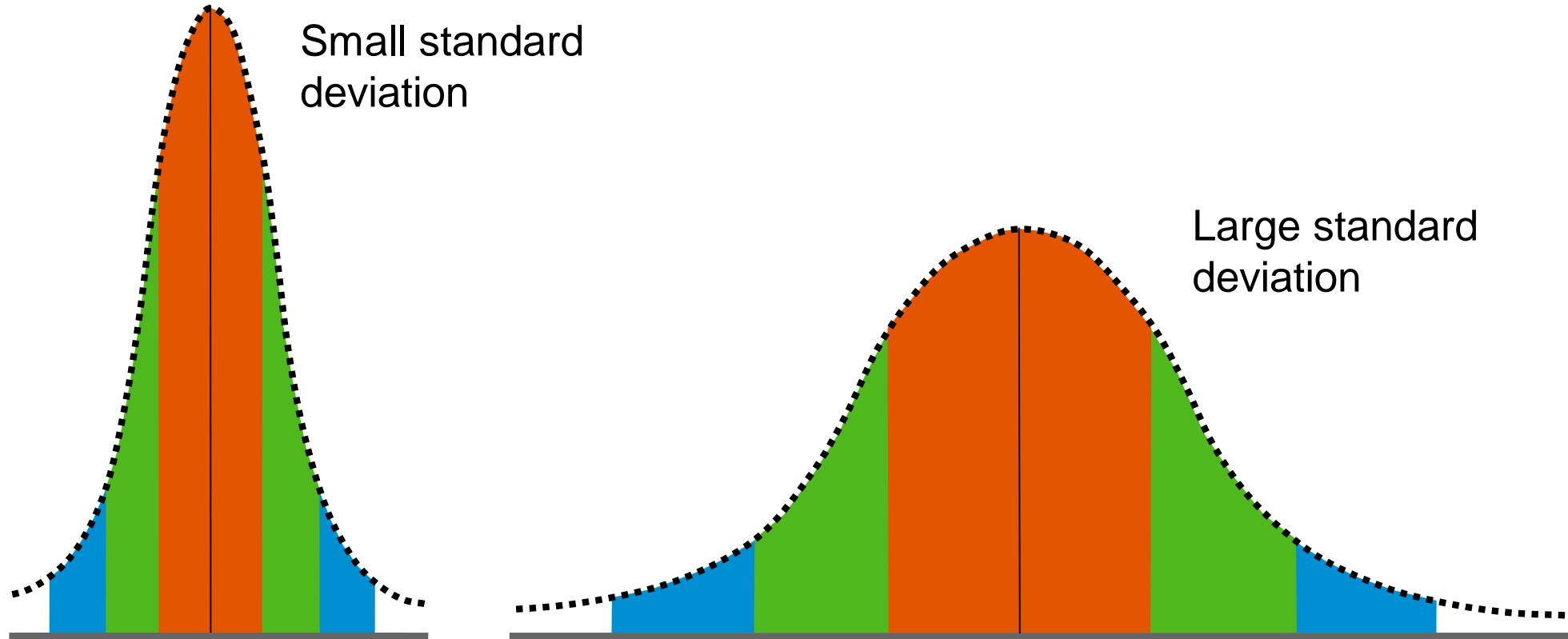


The three data sets below may seem to have the same variability but in fact the variation is not the same:

<b>Data Set A:</b>	1, 2, 3, 3, 4, 5	<b>Range:</b> $5 - 1 = 4$
<b>Data Set B:</b>	1, 1, 3, 3, 5, 5	<b>Range:</b> $5 - 1 = 4$
<b>Data Set C:</b>	1, 1, 1, 5, 5, 5	<b>Range:</b> $5 - 1 = 4$

## Measures of Dispersion

### Standard deviation



## Standard deviation for sample or population

- Standard deviation can be applied to a sample and a population
- The formulas to calculate standard deviation are:

### Population standard deviation:

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

#### **The population**

Number =  $N$

Mean =  $\mu$

Standard deviation =  $\sigma$

### Sample standard deviation:

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

#### **The sample**

Sample size =  $n$

Sample mean =  $\bar{x}$

Sample standard deviation =  $s$

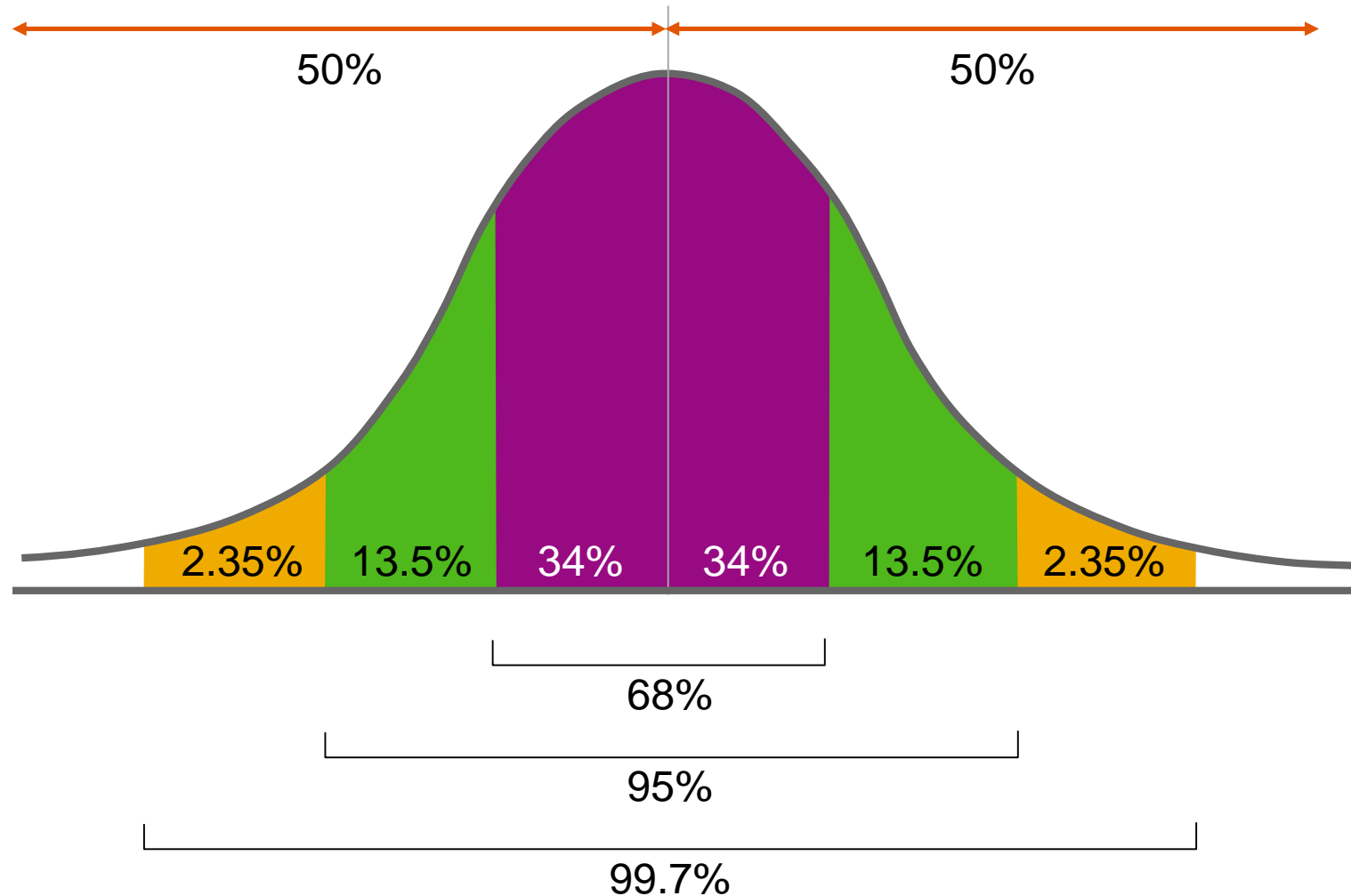
For more information see:

<https://www.khanacademy.org/math/statistics-probability/summarizing-quantitative-data/variance-standard-deviation-sample/a/population-and-sample-standard-deviation-review>

and

<https://www.mathsisfun.com/data/standard-deviation-formulas.html>

## Using the mean and standard deviation to describe data – The empirical rule



## Measures of Dispersion

### Variance

Sample Variance

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

Sample Standard Deviation

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

Symbols for variance and standard deviation:

$s^2 = \text{Sample variance}$

$s = \text{Sample standard deviation}$

$\sigma^2 = \text{Population variance}$

$\sigma = \text{Population standard deviation}$



## Measures of Dispersion

### Summary

- You have seen why looking at the range or average values of a distribution without considering the dispersion will not give you a full understanding of the data.
- Common measures include variance and standard deviation.
- You have also been introduced to the Empirical Rule that helps explain the spread in a distribution.



# Thank you.

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