Measures of Central Tendency of the Data

Skewness, Mean, Median and Mode

Noara Razzak

May 9, 2020

Measures of Central Tendency

Measures of Central Tendency are statistical measures that identify the center of a dataset.

Mean ($\bar{x}$)

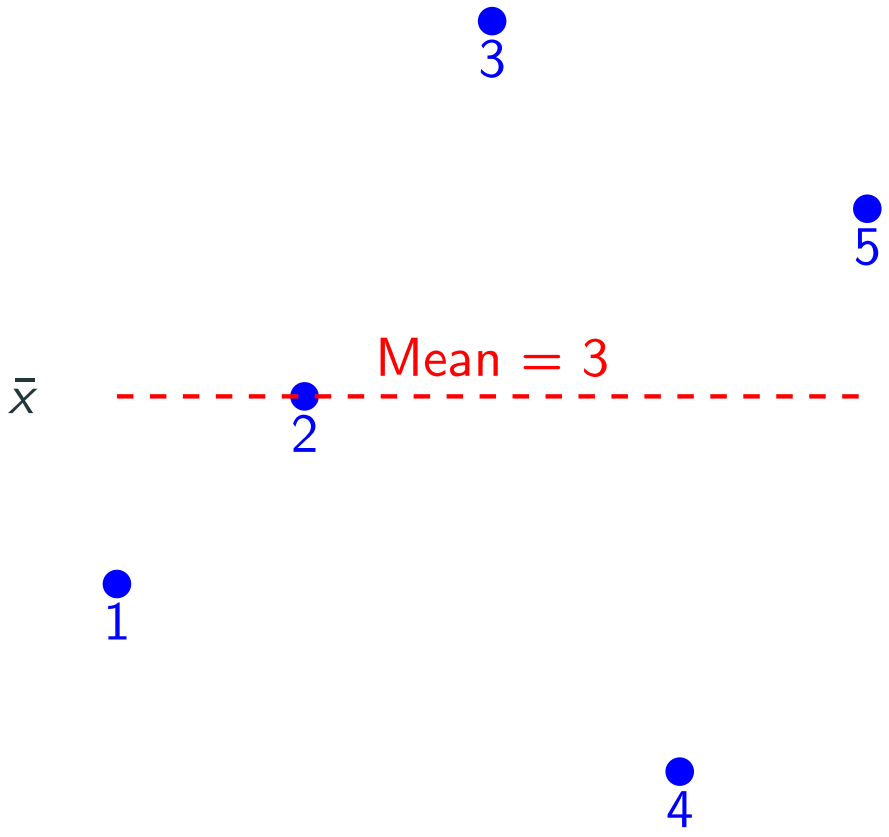
Mean is the arithmetic average of all data points.

$$\bar{x} = \frac{1}{n} \sum_{i=1}^{n} x_i$$

Example: For $[3, 5, 7, 9]$,

$$\bar{x} = \frac{3 + 5 + 7 + 9}{4} = 6$$

Mean ($\bar{x}$)



Median ($\tilde{x}$)

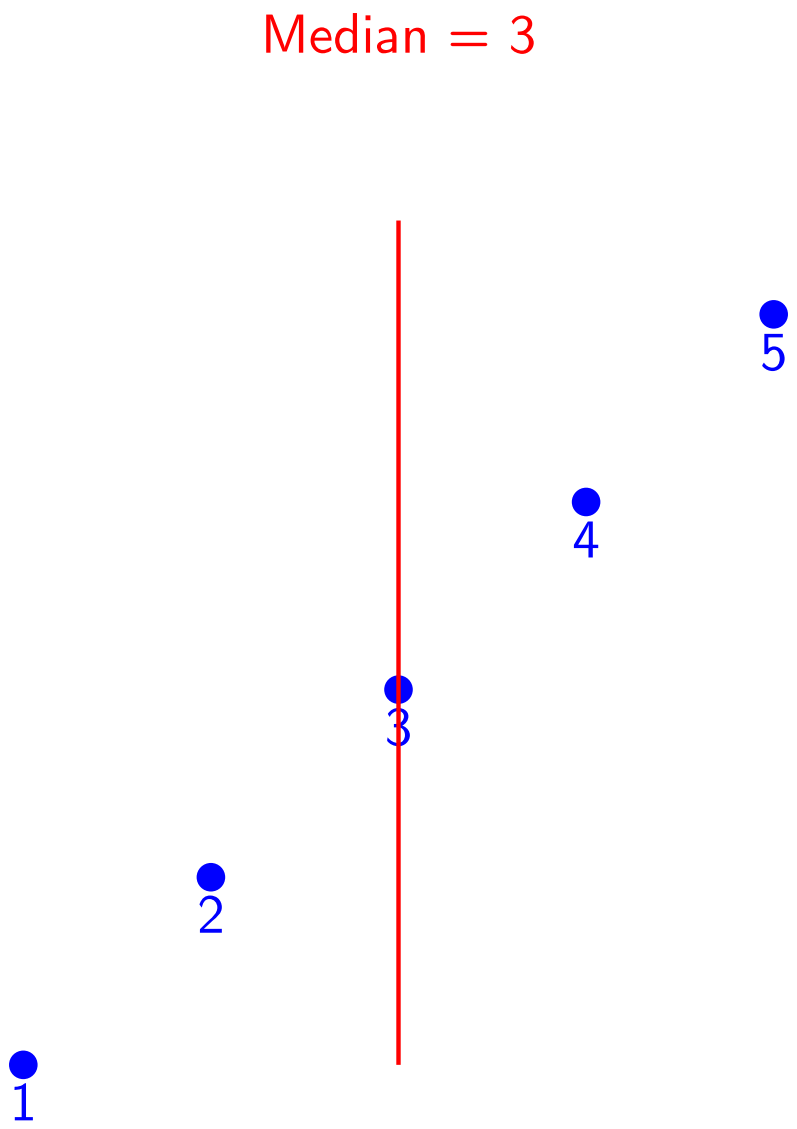
Median is the middle value in an ordered dataset.

$$\tilde{x} = \begin{cases} x_{\frac{n+1}{2}} & \text{if } n \text{ is odd,} \\ \frac{x_{\frac{n}{2}} + x_{\frac{n}{2}+1}}{2} & \text{if } n \text{ is even.} \end{cases}$$

Example:

- Odd case $[3, 5, 7]$: $\tilde{x} = 5$.
- Even case $[3, 5, 7, 9]$: $\tilde{x} = \frac{5+7}{2} = 6$.

Median ($\tilde{x}$)



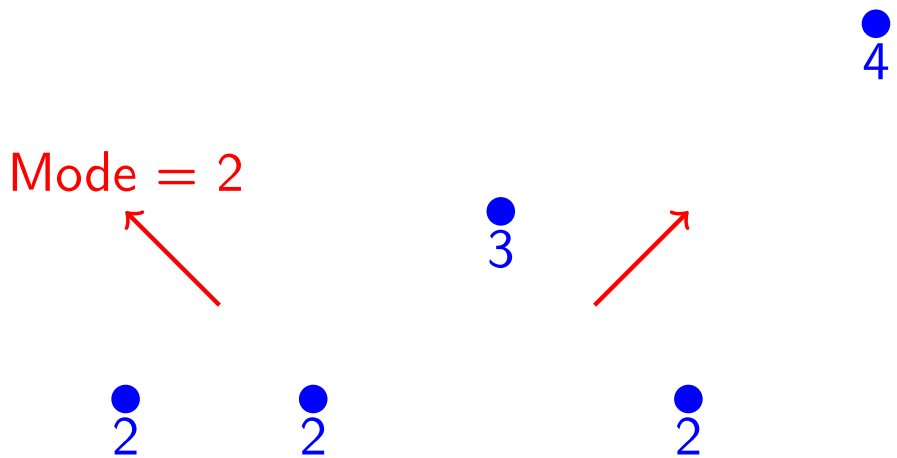
Mode (M)

Mode is the most frequently occurring value(s) in a dataset. A dataset can be:

- **Unimodal**: One mode.
- **Bimodal**: Two modes.
- **Multimodal**: Multiple modes.
- **No mode**: All values are unique.

Example: $[3, 5, 5, 7]$ has mode 5.

Mode (M)



Skewness

Skewness measures the asymmetry of the data distribution.

Types of Skewness

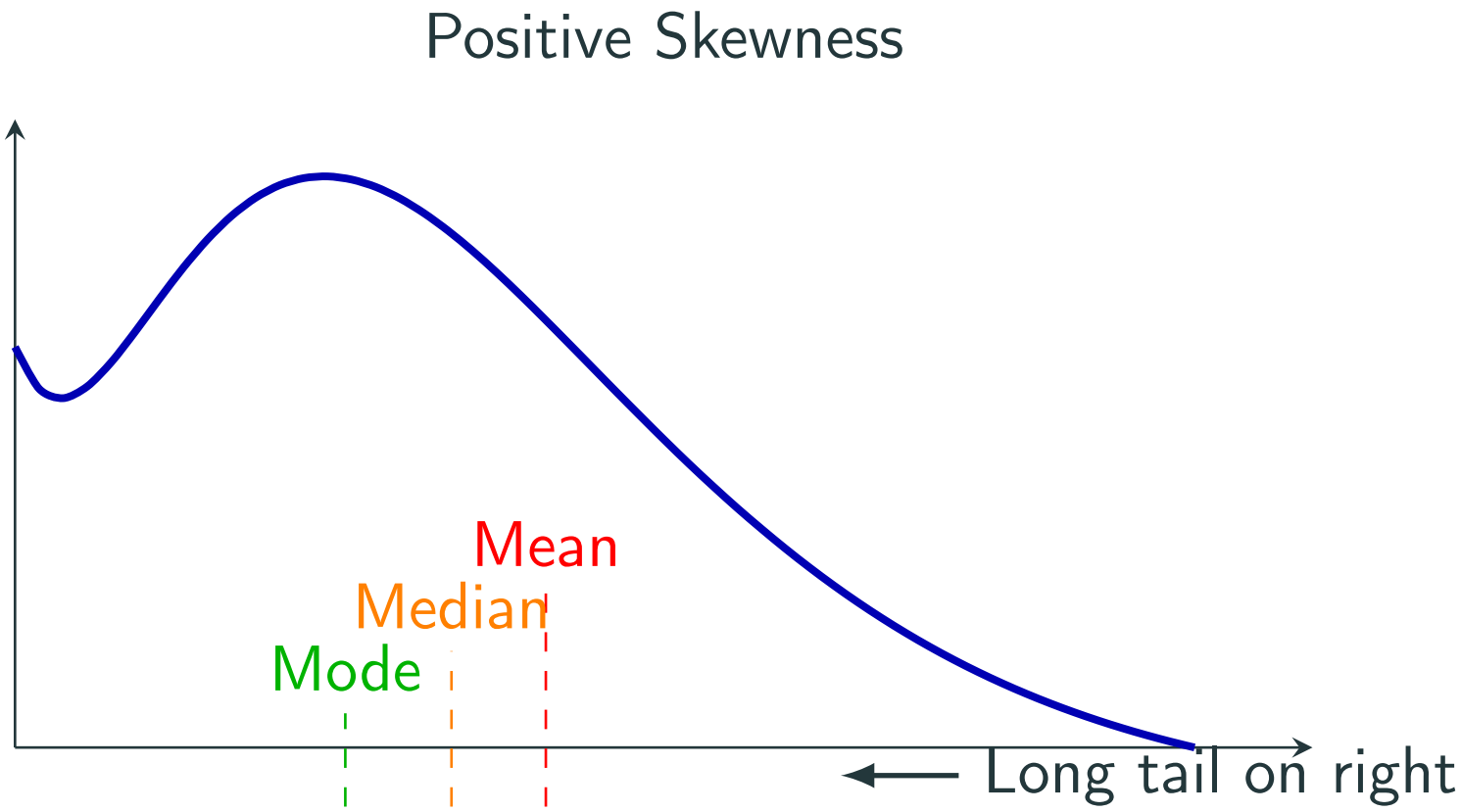
- Right (Positive) Skewness: Mean $>$ Median. Tail extends to the right.
- Left (Negative) Skewness: Mean $<$ Median. Tail extends to the left.
- Symmetric (Zero Skewness): Mean $=$ Median $=$ Mode.

Pearson's Skewness Coefficient

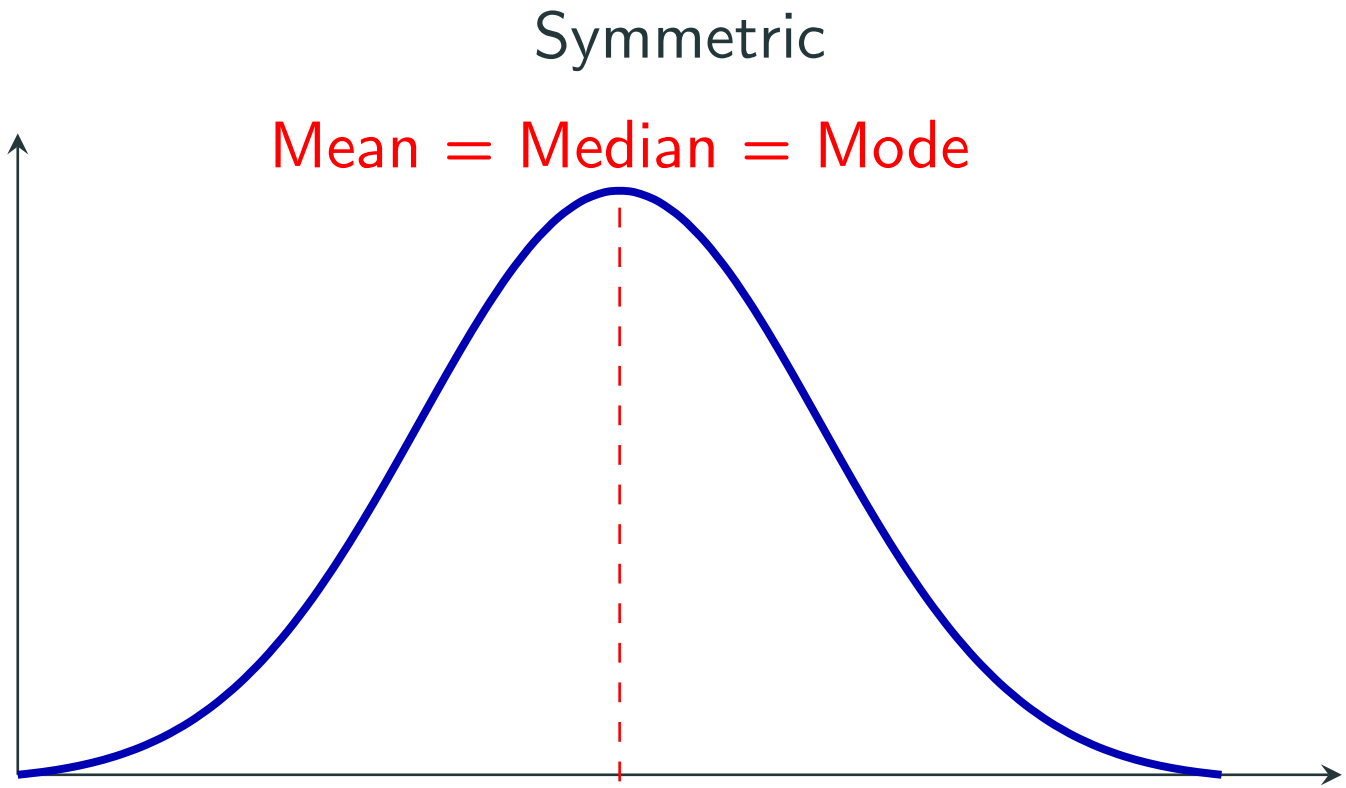
$$\text{Skewness} = \frac{3(\bar{x} - \tilde{x})}{\sigma}$$

where σ is the standard deviation.

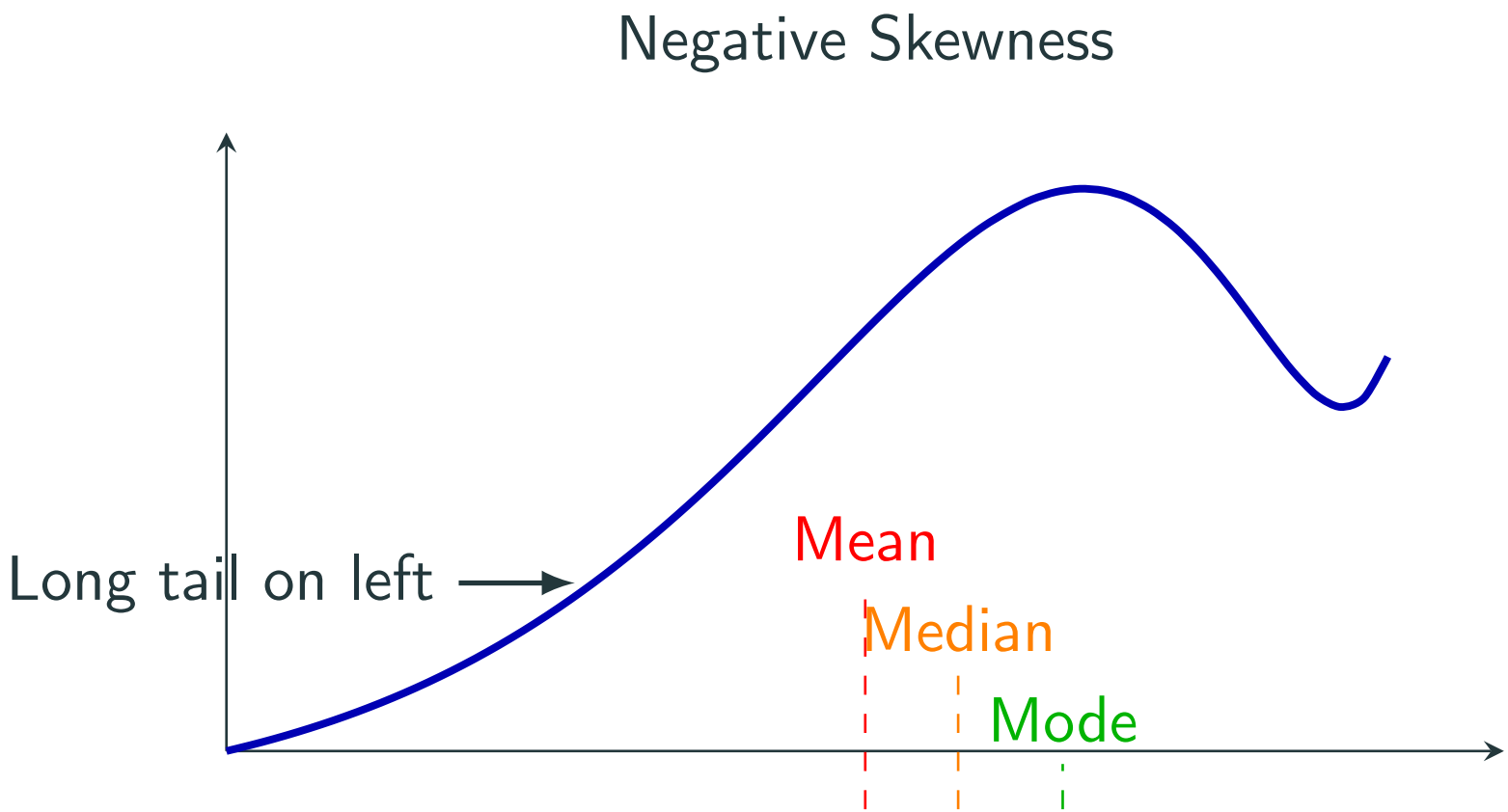
Right-skewed data



No Skewness



Left-Skewed



Next class we will cover the basics of probability, independent and mutually exclusive events and conditional probability.