**Measures of Dispersion: Range and IQR**

Measures of dispersion describe how spread out the values in a dataset are. Two important measures are **Range** and **Interquartile Range (IQR)**.

#### **1. Range**

* **Definition:** The range is the difference between the maximum and minimum values in a dataset.
* **Formula:**



* **Example:** Suppose we have a dataset: **{3, 7, 12, 18, 21}**
  + Maximum value = **21**
  + Minimum value = **3**
  + Range = **21 - 3 = 18**
* **Pros & Cons:** ✅ Easy to calculate  
   ❌ Affected by outliers

#### **2. Interquartile Range (IQR)**

* **Definition:** The **Interquartile Range (IQR)** measures the spread of the middle **50%** of the data by calculating the difference between the **third quartile (Q3)** and the **first quartile (Q1)**.
* **Formula:**  
   Where:
  + **Q1 (First Quartile):** The 25th percentile (lower quartile)
  + **Q3 (Third Quartile):** The 75th percentile (upper quartile)
* **Example:** Consider the dataset **{1, 3, 5, 7, 9, 11, 13, 15, 17}**
  + Q1 = **5** (25th percentile)
  + Q3 = **13** (75th percentile)
  + IQR = **13 - 5 = 8**
* **Pros & Cons:** ✅ Not affected by outliers  
   ✅ Gives a better idea of the central spread  
   ❌ Slightly complex to calculate

#### **Comparison: Range vs. IQR**

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#### IQR is often preferred in real-world scenarios where outliers exist, such as finance, medical research, and machine learning.