

## Cumulative Frequency Diagrams

### 1. Drawing and Interpreting Cumulative Frequency Tables and Diagrams

A **cumulative frequency table** shows the accumulation of frequencies from a data set. It's useful for determining how many data points fall below a certain value. The cumulative frequency is calculated by adding the frequency of each class interval to the sum of the frequencies of all previous intervals.

#### Steps to Draw a Cumulative Frequency Table:

- 1. Organize Data:** Start by organizing your data into class intervals (e.g., 0-10, 10-20, etc.).
- 2. Calculate Cumulative Frequency:** The cumulative frequency is the sum of all frequencies up to the class interval.
- 3. Plot the Cumulative Frequency Diagram:**
  - **Plotting Points:** On the x-axis, place the upper boundaries of each class interval. On the y-axis, plot the cumulative frequency.
  - **Marking Points:** Mark each point clearly (e.g., with crosses or dots).
  - **Smooth Curve:** Join the points with a smooth curve (usually a line, not a jagged one).

#### Example:

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Age Interval (Years)	Frequency	Cumulative Frequency
0 - 10	5	5
10 - 20	8	13
20 - 30	12	25
30 - 40	6	31
40 - 50	4	35

Now, plot the cumulative frequency diagram with class intervals on the x-axis (e.g., 10, 20, 30, 40, 50) and cumulative frequency on the y-axis (e.g., 5, 13, 25, 31, 35).

**2. Estimating and Interpreting the Median, Percentiles, Quartiles, and Interquartile Range (IQR)**

Once the cumulative frequency diagram is plotted, you can estimate various statistical values.

- **Median:**

- The median is the value that divides the data into two equal parts. To find it:
  1. Locate the total number of data points (e.g., if there are 35 total points, half of that is 17.5).
  2. Find the point on the cumulative frequency diagram where the cumulative frequency is closest to this value (17.5 in this case).
  3. The corresponding value on the x-axis is the median.

- **Percentiles:**

- Percentiles divide the data into 100 equal parts. To estimate a specific percentile (e.g., the 70th percentile), find the cumulative frequency corresponding to that percentile (e.g., 70% of the total data) and locate the corresponding value on the x-axis.

- **Quartiles:**

- Quartiles divide the data into four equal parts:
  - **Q1 (First Quartile):** The value at the 25th percentile (first 25% of the data).
  - **Q3 (Third Quartile):** The value at the 75th percentile (first 75% of the data).
  - **Interquartile Range (IQR):** The difference between Q3 and Q1, representing the range within which the central 50% of the data lies.

**To find quartiles from a cumulative frequency diagram:**

1. Q1 is found by locating the point corresponding to 25% of the total number of data points.
2. Q3 is found by locating the point corresponding to 75% of the total number of data points.
3. Calculate IQR as:  
$$\text{IQR} = \text{Q3} - \text{Q1}$$

**Example of Finding the Median and Quartiles from a Cumulative Frequency Diagram:**

From the cumulative frequency table above, the total number of data points is 35.

- **Median:** 50% of 35 is 17.5. Find the cumulative frequency closest to 17.5, which is 13 (from the 10-20 interval). The median lies in the 20-30 interval.
- **Q1 (First Quartile):** 25% of 35 is 8.75. The cumulative frequency closest to 8.75 is 8 (from the 10-20 interval), so Q1 lies in the 10-20 interval.
- **Q3 (Third Quartile):** 75% of 35 is 26.25. The cumulative frequency closest to 26.25 is 25 (from the 20-30 interval), so Q3 lies in the 20-30 interval.
- **IQR:** If Q1 is approximately 15 and Q3 is approximately 25, then:
  - $\text{IQR} = 25 - 15 = 10$

By interpreting the cumulative frequency diagram, you can visually estimate these key statistics.