

## Frequency Distribution of Ungrouped Data

The frequency is the number of times the value occurs in the data set. A frequency distribution is an organization of raw data in tabular form, using classes (or intervals) and frequencies.

The total of the frequencies in the distribution is symbolized by the letter  $N$ . The frequency distribution might show a pattern in the set that is not apparent when simply examining the individual values.

The types of frequency distributions that will be considered in this section are categorical, and ungrouped frequency distribution

**Definition 1: Categorical Frequency:** Categorical frequency distributions represent data that can be placed in specific categories, such as gender, hair color, or religious affiliation.

**Example 1:** Using the key: **H** = Handball, **B** = Basketball, **F** = Football, each letter below indicates a student joining the sports club.

H H B F B H F F H B

B B H F H H F B H B

Construct a frequency table for the data.

First, we tally the student count by the clubs they belong to. The total number of counts each club receives is the frequency of the number of students joining that club. We organize the data in the frequency table. We will represent the clubs as classes and the number of students joining the clubs as frequencies.

Club	Tally	Frequency
Handball		8
Basketball		7
Football		5

**Definition 2: Ungrouped frequency distribution:** An ungrouped frequency distribution simply lists the data values with the corresponding number of times or frequency count with which each value occurs.

**Example 2:** The following data represents the number of defectives observed each day over a 16-day period for a manufacturing process. Summarize the information with a frequency distribution.

Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Defects	10	10	6	12	12	6	9	16	11	11	12	9	6	6	9	8

The frequency distribution for the number of defects is shown in table below:

Class( Defects)	Tally	Frequency
6	IIII	4
8	I	1
9	III	3
10	II	2
11	II	2
12	III	3
16	I	1

Sometimes frequency distributions are displayed with the **relative frequencies** as well.

**Definition 3: Relative Frequency:** The relative frequency for any class is obtained by dividing the frequency for that class by the total number of observations.

$$rel. freq. = \frac{f}{n}$$

Where  $f$  represents the frequency,  $n$  represents the total frequency.

**Example 3:** The frequency distribution in the table below uses the data in the previous example and displays the relative frequencies and the corresponding percentages.

Class(Defects)	Frequency $f$	Relative Frequency	Percentage %
6	4	$\frac{4}{16} = 0.25$	25
8	1	$\frac{1}{16} = 0.0625$	6.25
9	3	$\frac{3}{16} = 0.1875$	18.75
10	2	$\frac{2}{16} = 0.125$	12.5
11	2	$\frac{2}{16} = 0.125$	12.5
12	3	$\frac{3}{16} = 0.1875$	18.75
16	1	$\frac{1}{16} = 0.0625$	6.25
<b>Total</b>	16	1	100

**Rule:** Frequency percentage =  $\frac{\text{actual frequency}}{\text{total frequency}} \times 100$

Sometimes frequency distributions are displayed with the **cumulative frequencies** and **cumulative relative frequencies** as well.

**Definition 4: Cumulative frequency:** The cumulative frequency for a specific value in a frequency table is the sum of the frequencies for all values at or below the given value.

Cumulative frequency distribution has a running total of the values. It is constructed by adding the frequency of the first class interval to the frequency of the second class interval. Again add that total to the frequency in the third class interval continues until the final total appearing opposite to the last class interval will be the total of all frequencies.

The cumulative frequency may be downward (increasing) or upward (decreasing).

**Definition 5:** A downward cumulating results in a list presenting the number of frequencies “less than” any given amount as revealed by the lower limit of succeeding class interval and the upward cumulative results in a list presenting the number of frequencies “more than” and given amount is revealed by the upper limit of a preceding class interval.

**Example 4:**

Age group (in years)	Number of women	Increasing Cumulative frequency	Decreasing Cumulative frequency
15-20	3	3	64
20-25	7	10	61
25-30	15	25	54
30-35	21	46	39
35-40	12	58	18
40-45	6	64	6

**Definition 6: Cumulative relative frequency:** The cumulative relative frequency for a specific value in a frequency table is the sum of the relative frequencies for all values at or below the given value.

**Example 5:** The frequency distribution in the table below uses the data in the example and also displays the cumulative frequencies and the cumulative relative frequencies.

Class (Defects)	Frequency f	Relative Frequency	Cumulative Frequency	Cumulative relative frequency
6	4	0.25	4	0.25
8	1	0.0625	5	0.3125
9	3	0.1875	8	0.5
10	2	0.125	10	0.625
11	2	0.125	12	0.75
12	3	0.1875	15	0.9375
16	1	0.0625	16	1.00