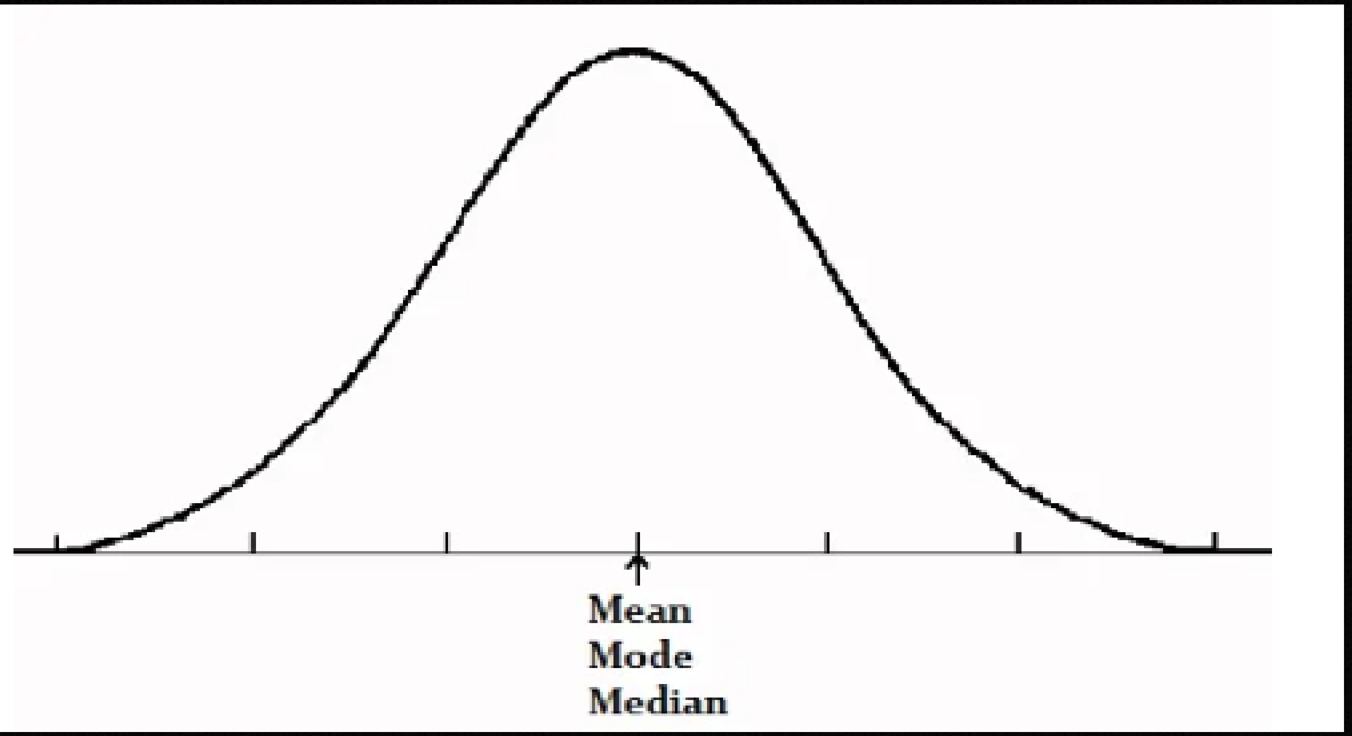
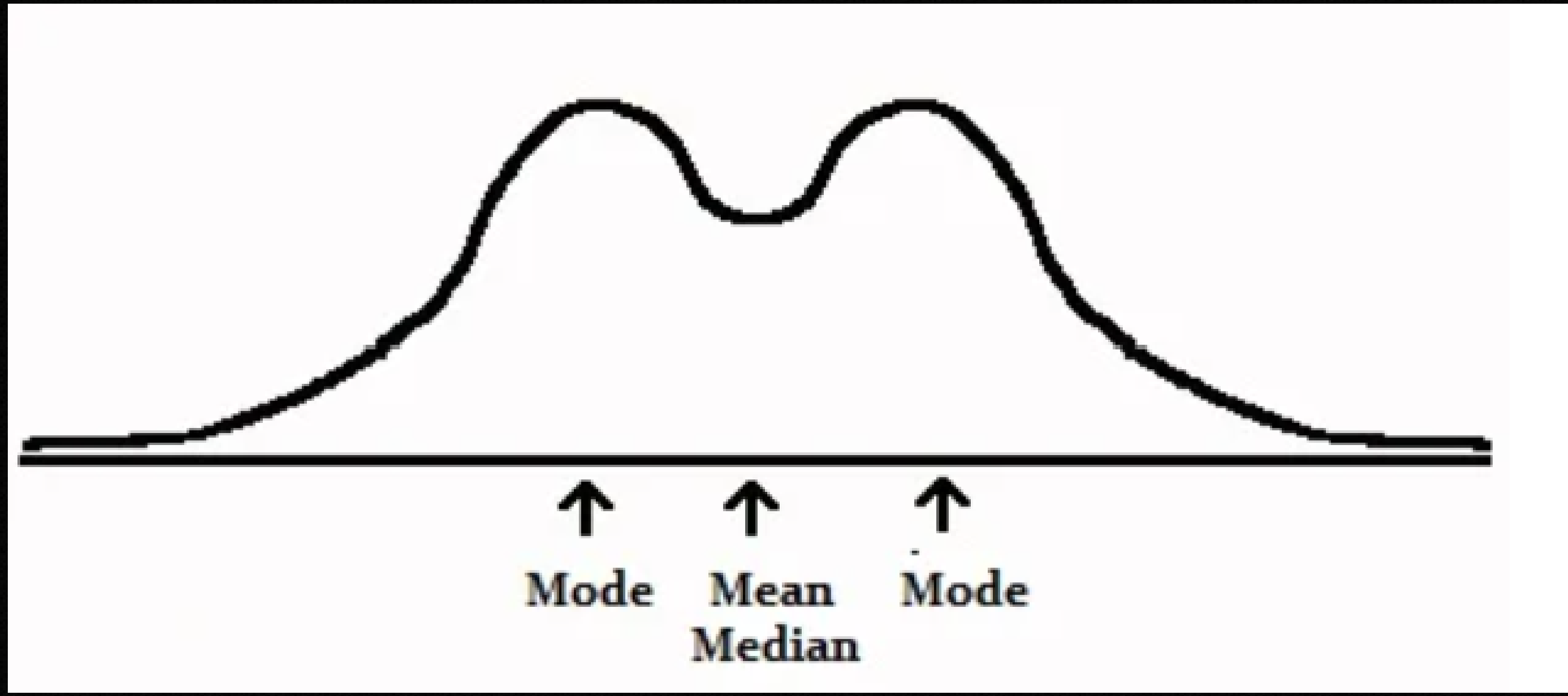
Symmetric Distribution:

shape of the left side of mean is mirror image of shape of right side of mean in symmetric distributions

A probability distribution is said to be symmetric if and only if there exists a value x0 such that f(x0 - δ) = f(x0 + δ) for all real numbers δ, where f is the probability density function if the distribution is continuous or the probability mass function if the distribution is discrete.

Example: Gaussian distribution is symmetric

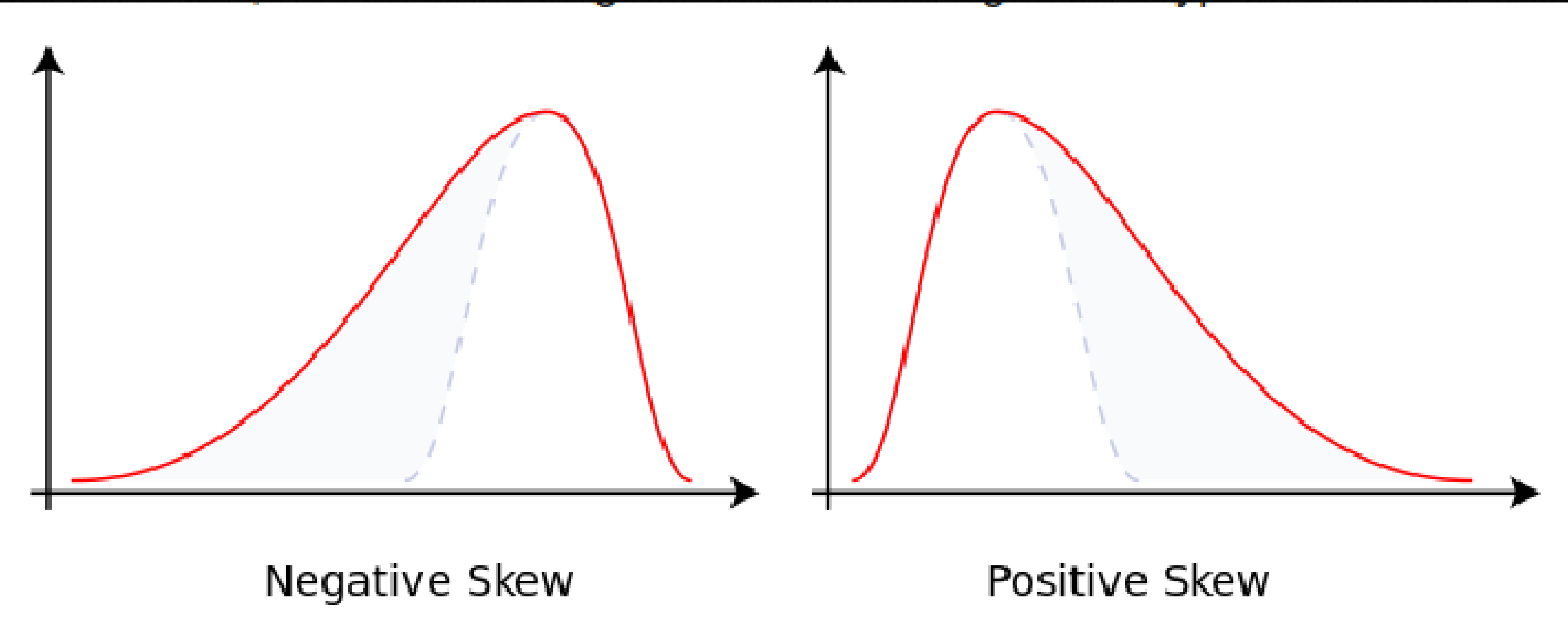




Skewness:

In probability theory and statistics, skewness is a measure of the asymmetry of the probability distribution of a real-valued random variable about its mean. The skewness value can be positive, zero, negative, or undefined.

Negative skew commonly indicates that the tail is on the left side of the distribution, and positive skew indicates that the tail is on the right



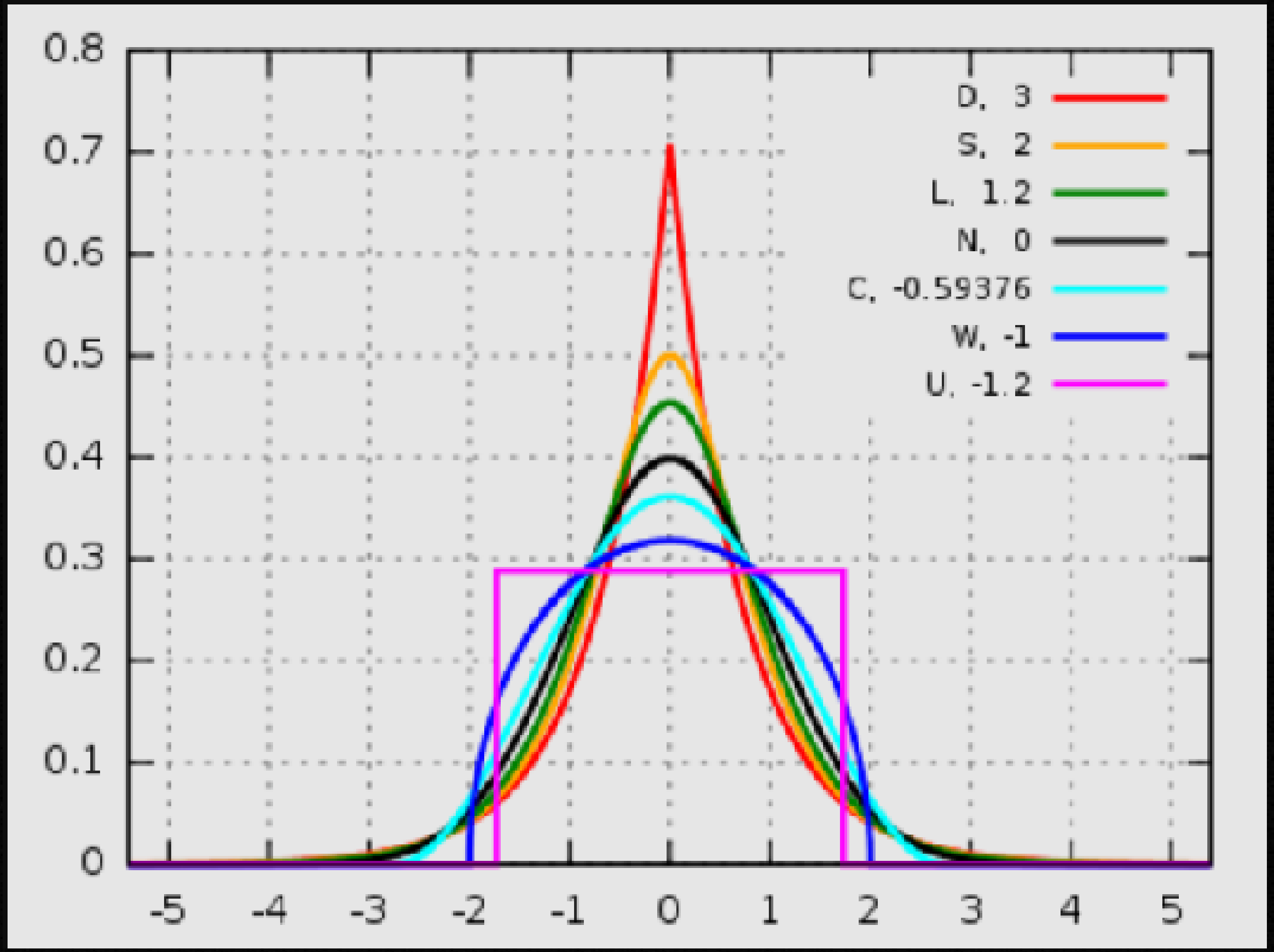
For a sample of n values, estimators of the population skewness is

$$b_1 = \frac{m_3}{s^3} = \frac{\frac{1}{n}\sum_{i=1}^{n}(x_i - \overline{x})^3}{\left[\frac{1}{n-1}\sum_{i=1}^{n}(x_i - \overline{x})^2\right]^{3/2}}$$

Kurtosis:

All the kurtosis mentioned here are excess kurtosis. which is (kurtosis - 3) here 3 is kurtosis of normal distribution

In probability theory and statistics, kurtosis is a measure of the "tailedness" of the probability distribution of a real-valued random variable



D: Laplace distribution, also known as the double exponential distribution, red curve (two straight lines in the log-scale plot), excess kurtosis = 3

S: hyperbolic secant distribution, orange curve, excess kurtosis = 2

L: logistic distribution, green curve, excess kurtosis = 1.2

N: normal distribution, black curve (inverted parabola in the log-scale plot), excess kurtosis = 0

C: raised cosine distribution, cyan curve, excess kurtosis = −0.593762...

W: Wigner semicircle distribution, blue curve, excess kurtosis = −1

U: uniform distribution, magenta curve (shown for clarity as a rectangle in both images), excess kurtosis = −1.2.

For a sample of n values, a method of moments estimator of the population excess kurtosis can be defined as

$$g_2 = \frac{m_4}{m_2^2} - 3 = \frac{\frac{1}{n}\sum_{i=1}^{n}(x_i - \overline{x})^4}{\left[\frac{1}{n}\sum_{i=1}^{n}(x_i - \overline{x})^2\right]^2} - 3$$