

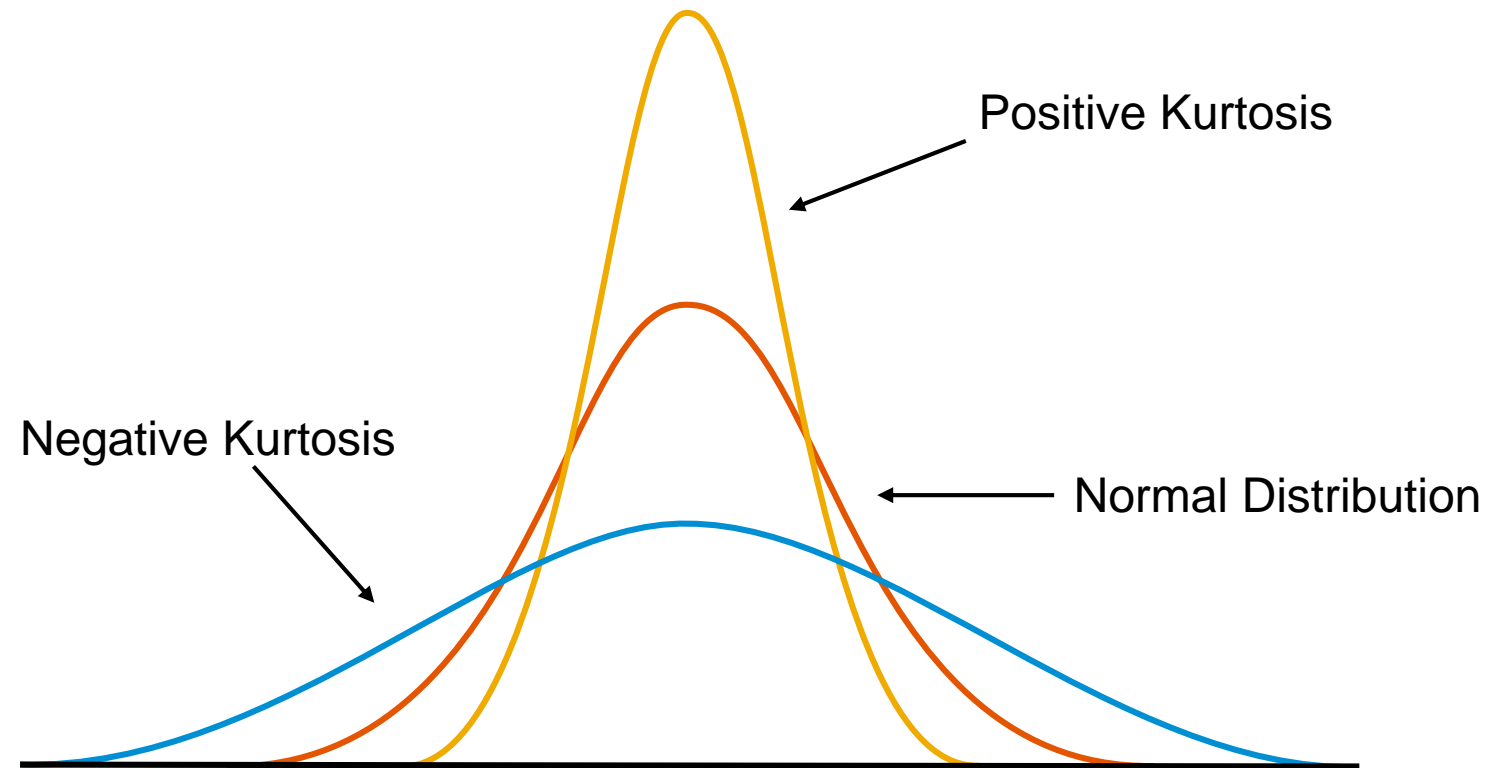


Week 5: Probability Distributions

## Unit 3: Kurtosis and Skewness

## Kurtosis and Skewness

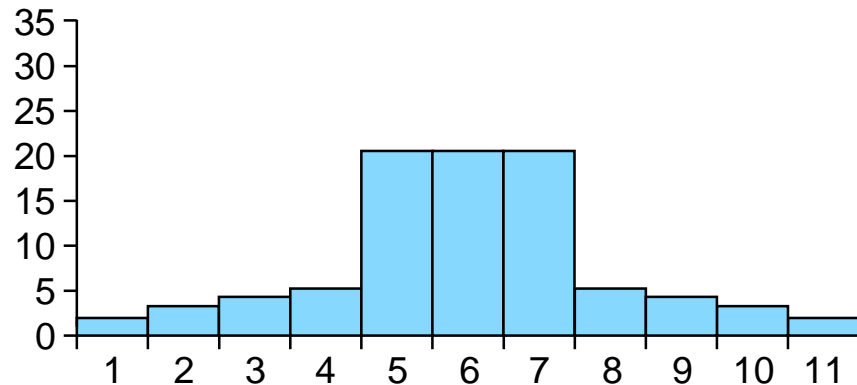
### Introduction to kurtosis



<https://www.statisticshowto.datasciencecentral.com/probability-and-statistics/statistics-definitions/kurtosis-leptokurtic-platykurtic/>

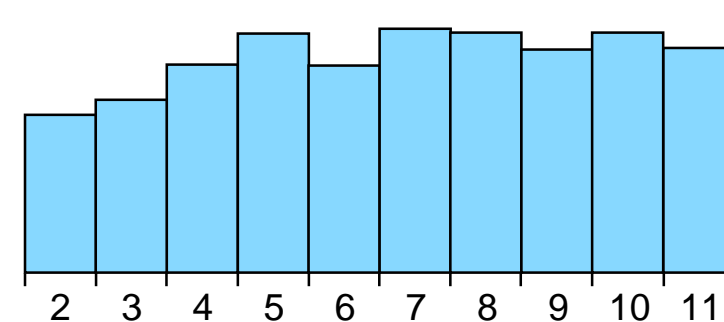
### Kurtosis

- Data sets with high, positive kurtosis tend to have heavy tails, or outliers.



- This distribution has positive kurtosis (heavier tails compared to the normal distribution)

- Data sets with low kurtosis tend to have light tails, or lack of outliers.



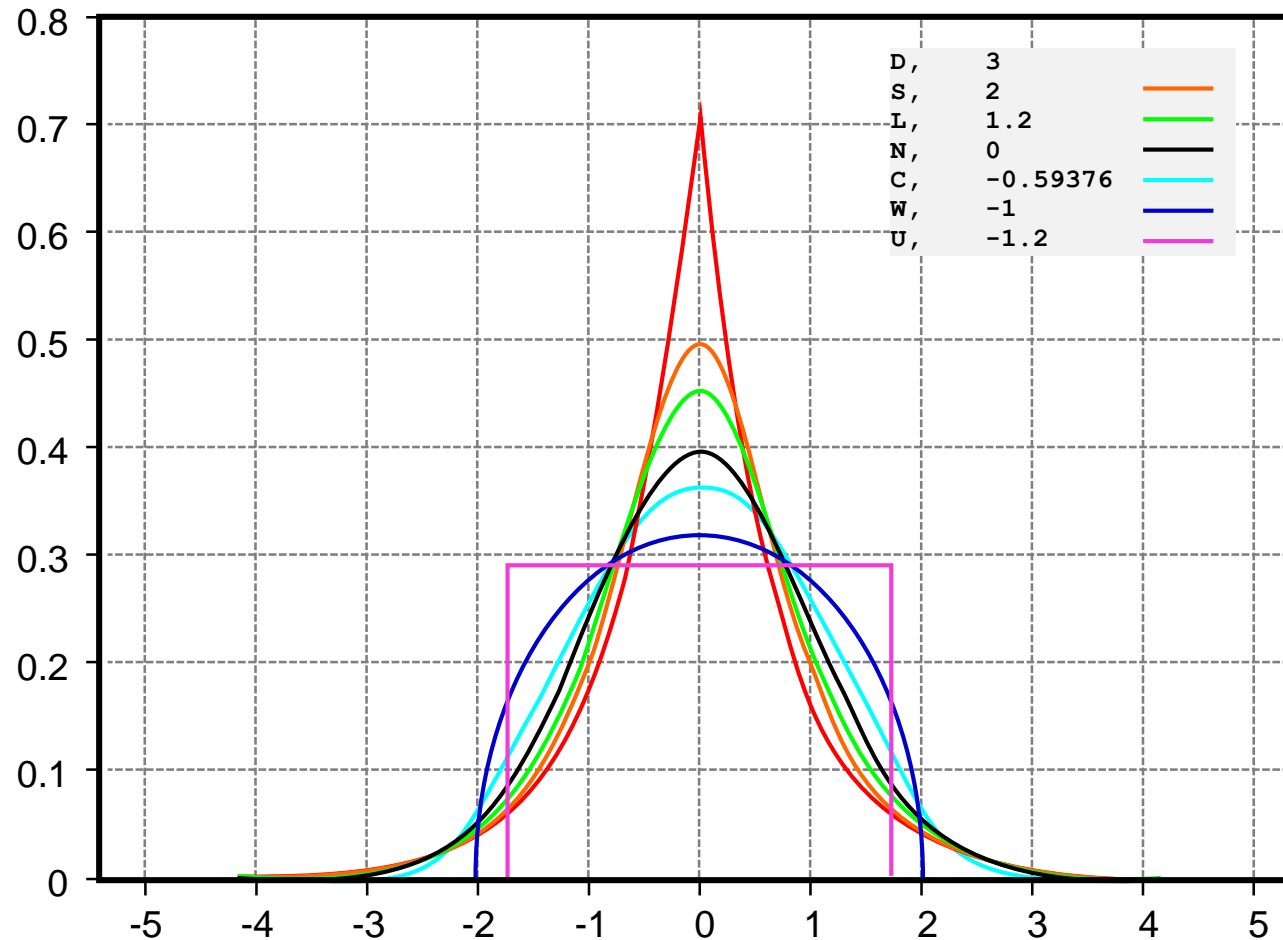
- This distribution has low kurtosis (no tails)

<https://en.wikipedia.org/wiki/Kurtosis>

<https://www.spcforexcel.com/knowledge/basic-statistics/are-skewness-and-kurtosis-useful-statistics>

# Kurtosis and Skewness

## Excess kurtosis



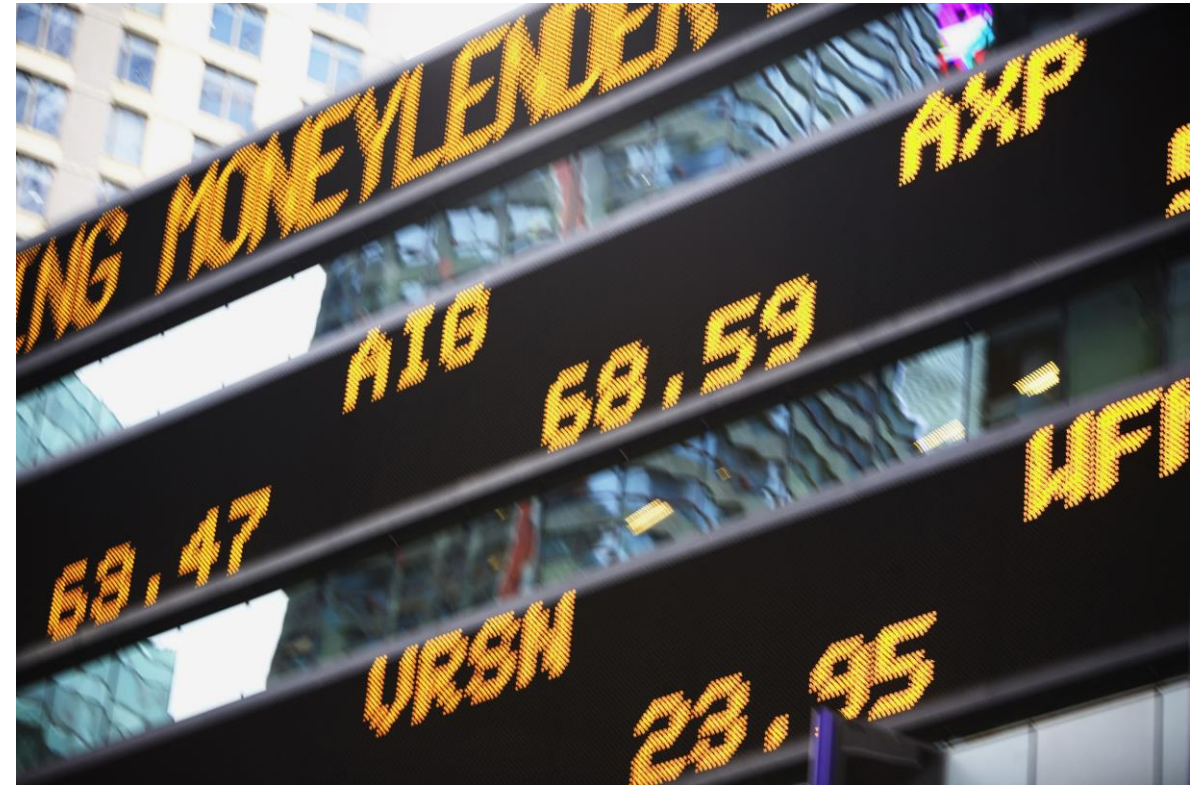
### Key:

Red, kurt 3, Laplace (D)ouble exponential distribution;  
Orange, kurt 2, hyperbolic (S)ecant distribution;  
Green, kurt 1.2, (L)ogistic distribution;  
Black, kurt 0, (N)ormal distribution;  
Cyan, kurt -0.593762..., raised (C)osine distribution;  
Blue, kurt -1, (W)igner semicircle distribution;  
Magenta, kurt -1.2, (U)niform distribution.

<https://www.statisticshowto.datasciencecentral.com/probability-and-statistics/statistics-definitions/kurtosis-leptokurtic-platykurtic/>

### Kurtosis in financial markets

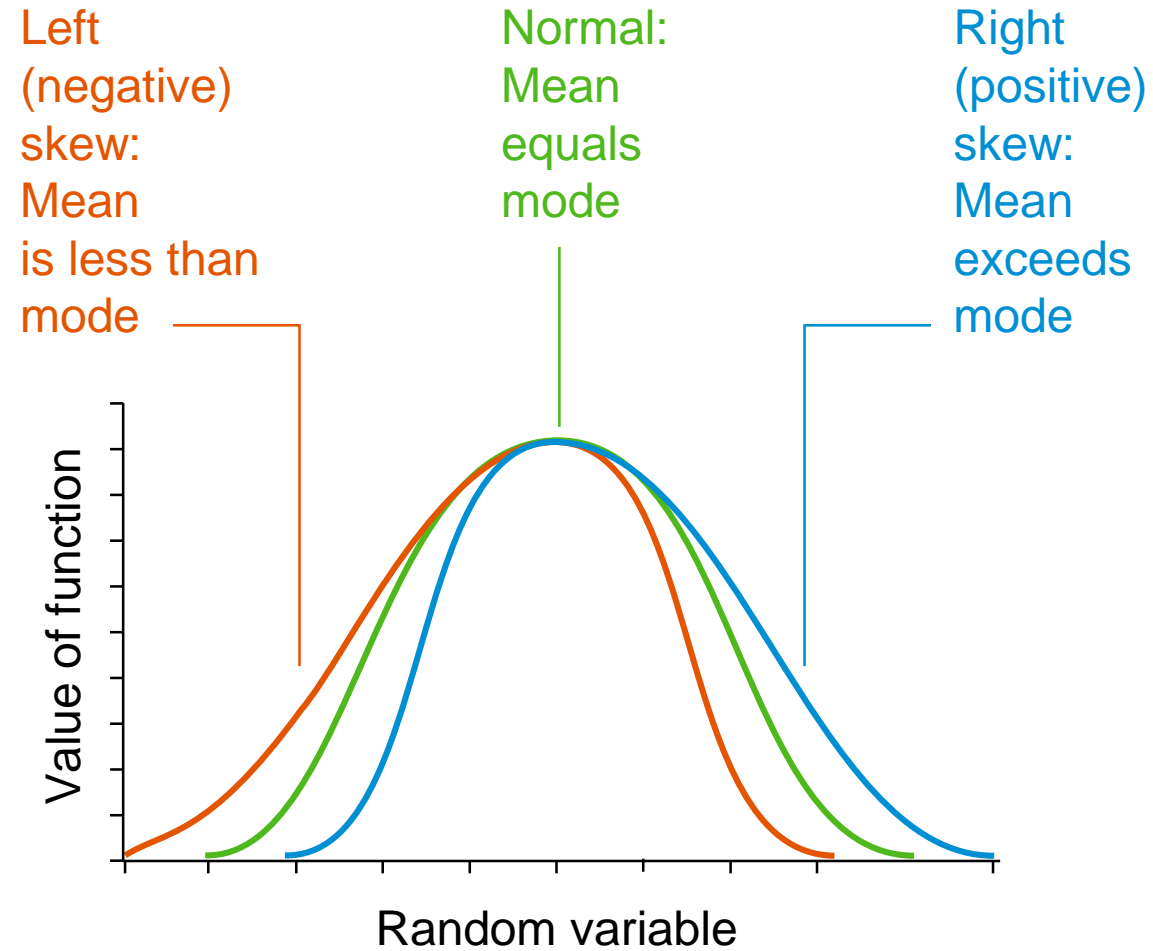
- Real estate (with a kurtosis of 8.75) and high yield US bonds (8.63) are high risk investments.
- Investment grade US bonds (1.06) and small cap US stocks (1.08) would be considered safer investments.



<https://www.statisticshowto.datasciencecentral.com/probability-and-statistics/statistics-definitions/kurtosis-leptokurtic-platykurtic/>

## Kurtosis and Skewness

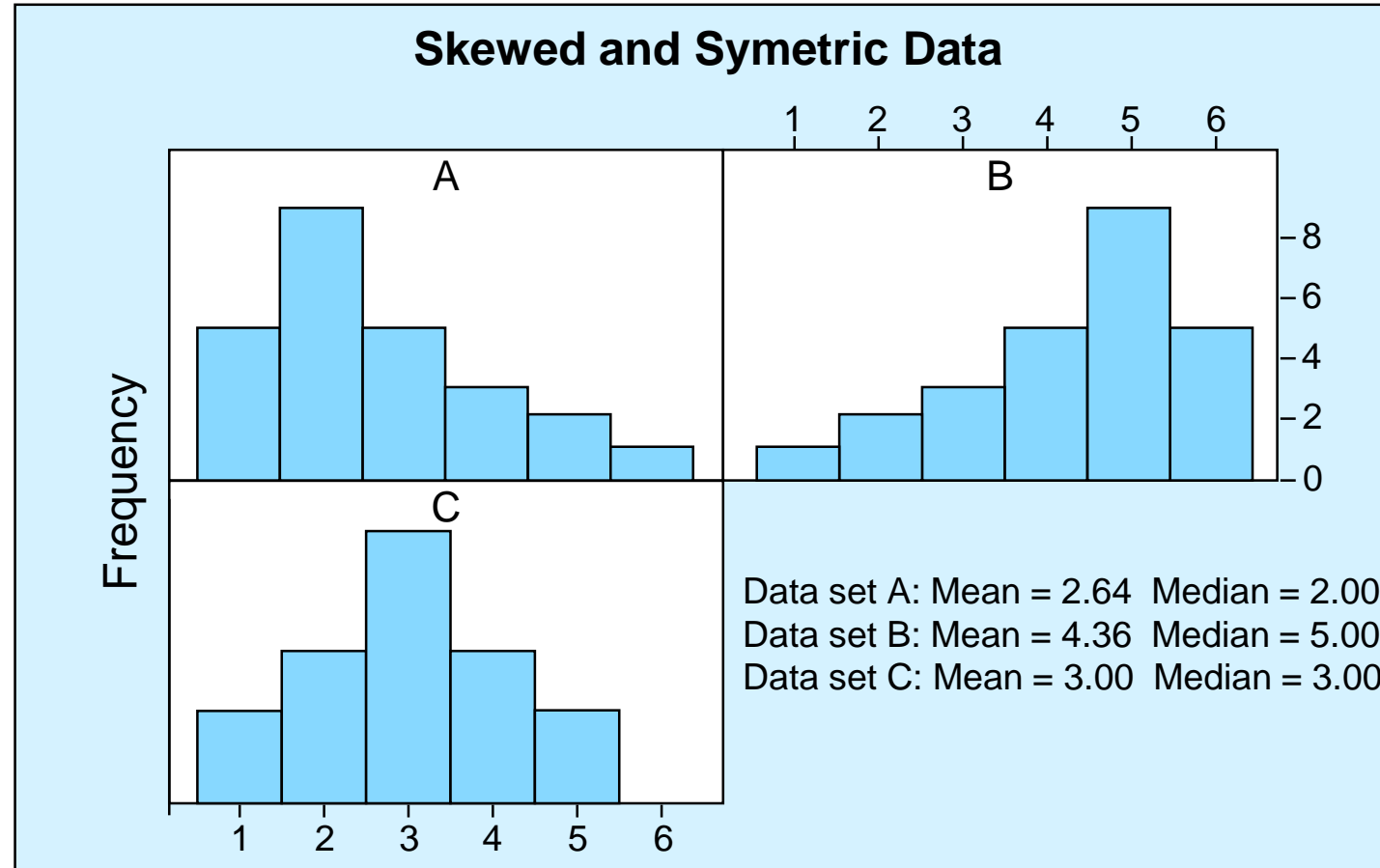
### Introduction to skewness



<https://www.itl.nist.gov/div898/handbook/eda/section3/eda35b.htm>  
<https://whatis.techtarget.com/definition/skewness>

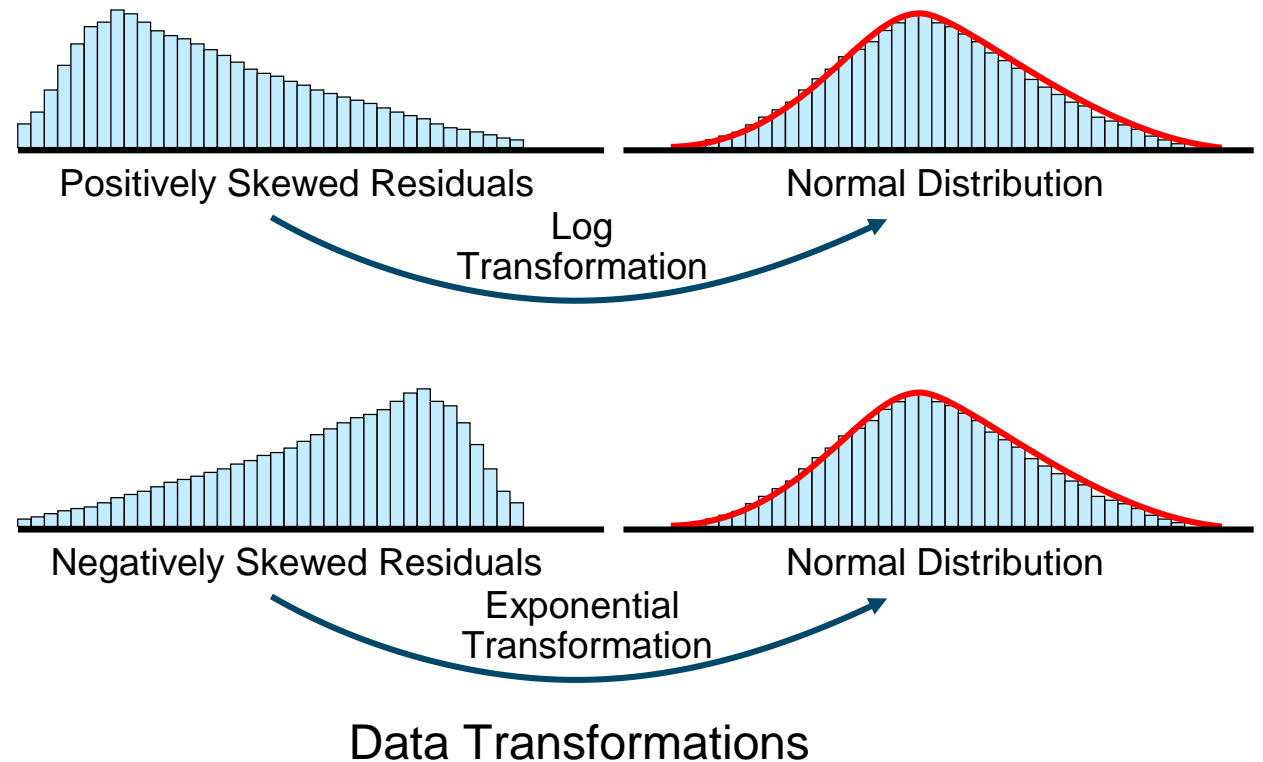
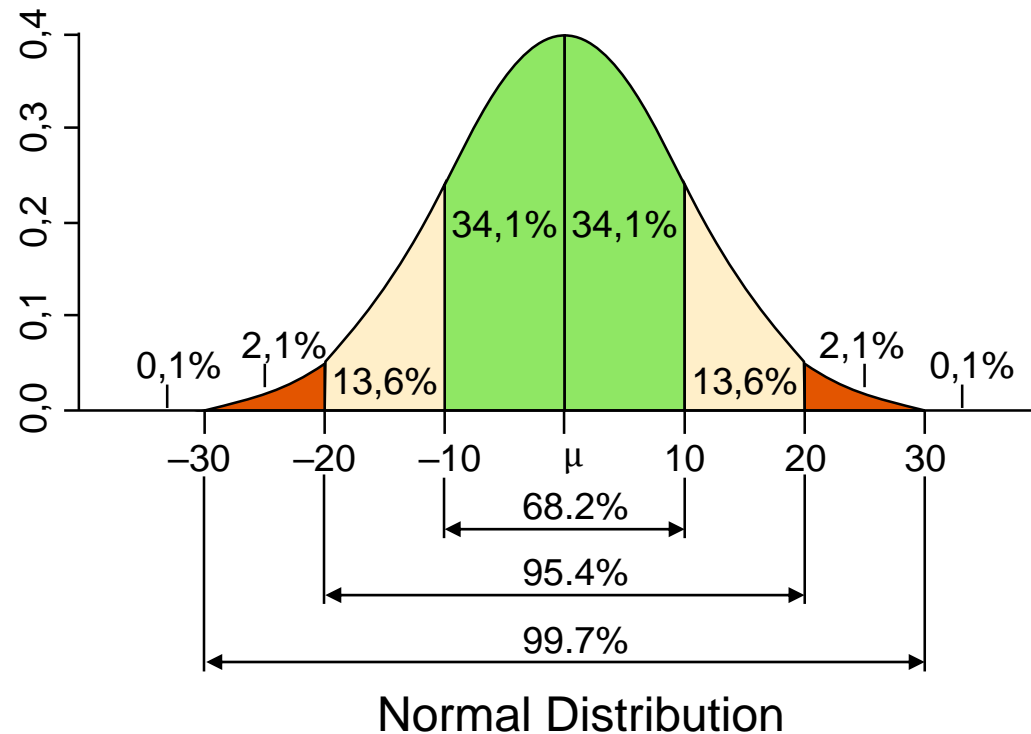
# Kurtosis and Skewness

## Mean and median



von Hippel, Paul T. (2005). ["Mean, Median, and Skew: Correcting a Textbook Rule"](https://en.wikipedia.org/wiki/Skewness). *Journal of Statistics Education*. **13** (2).  
<https://en.wikipedia.org/wiki/Skewness>

### Why is skew important?



[https://www.sheffield.ac.uk/polopoly\\_fs/1.579181!/file/stcp-marshallsamuels-NormalityS.pdf](https://www.sheffield.ac.uk/polopoly_fs/1.579181!/file/stcp-marshallsamuels-NormalityS.pdf)

<https://www.quora.com/How-does-skewness-affect-regression-model>

<https://www.itl.nist.gov/div898/handbook/eda/section3/eda35b.htm>

<https://www.linkedin.com/pulse/question-does-skewness-variable-affect-predictive-data-mosaddar> for more information



## Kurtosis and Skewness

### Summary

- Kurtosis is a measure of the "tailedness" of the probability distribution:
  - Data sets with high kurtosis tend to have heavy tails, or outliers (**"leptokurtic"**).
  - Data sets with low kurtosis tend to have light tails, or lack of outliers (**"platykurtic"**).
  - Distributions with zero excess kurtosis are called **"mesokurtic"** (normal distribution family).
- Skewness is a measure of the asymmetry of a probability distribution.
  - A distribution is symmetric if it looks the same to the left and right of the center point.
  - If most of the data is on the left side of the histogram but a few larger values are on the right, the data is said to be *skewed to the right (positive skew)*.
  - If most of the data is on the right, with a few smaller values showing up on the left side of the histogram, the data is *skewed to the left (negative skew)*.
  - If the distribution is symmetric, then the mean is equal to the median and the distribution has zero skewness. If the distribution is both symmetric and unimodal, then the mean = median = mode.



# Thank you.

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