Manhattan:

- **Description:**

When measuring the distance using manhattan method between two points in a 2D grid the result is: |x1 + x2| + |y1 + y2| = d.
Its primary use situation is when calculating the distance on a grid. This distance can be imagined as the length needed to move between two points in a grid where you can only move up, down, left or right.

- **Usage:**

- In chess, the distance between squares for a rook is measured with the Manhattan distance, as this piece can only travel horizontally and vertically.
- In data science and machine learning, the Manhattan distance is used in speech recognition and image processing.
- In molecular biology, the Manhattan distance is used to decide where to splice genes and other molecules.
- In the popular Snake video game genre, the number of steps your snake has to move towards the next food item can be determined with the Manhattan distance; this is how it earned the nickname "snake distance".

Euclidean:

- **Description:**

The Euclidean distance between two points in Euclidean space is the length of the line segment between them. It can be calculated from the Cartesian coordinates of the points using the Pythagorean theorem, and therefore is occasionally called the Pythagorean distance.
These names come from the ancient Greek mathematicians Euclid and Pythagoras. In the Greek deductive geometry exemplified by Euclid's Elements, distances were not represented as numbers but line segments of the same length, which were considered "equal". The notion of distance is inherent in the compass tool used to draw a circle, whose points all have the same distance from a common center point. The connection from the Pythagorean theorem to distance calculation was not made until the 18th century.
The distance between two objects that are not points is usually defined to be the smallest distance among pairs of points from the two objects. Formulas are known for computing distances between different types of objects, such as the distance from a point to a line. In advanced mathematics, the concept of distance has been generalized to abstract metric spaces, and other distances than Euclidean have been studied. In some applications in statistics and optimization, the square of the Euclidean distance is used instead of the distance itself.
When calculating between two 2D points.

d(p1, p2) = sqrt((x1 - x2)^2 + (y1 - y2)^2)

When calculating between two points in n-dimension.

d(p1, p2) = sqrt((x1 - x2)^2 + (y1 - y2)^2 + … (n1 - n2)^2)

- **Usage:**

It is commonly used in most video games for measuring the distance between two objects or to get the distance of a vector.
It is also heavily used with maps.

Hamming:

- **Description**:

The Hamming distance between two equal-length strings of symbols is the number of positions at which the corresponding symbols are different.

In information theory, the Hamming distance between two strings or vectors of equal length is the number of positions at which the corresponding symbols are different. In other words, it measures the minimum number of substitutions required to change one string into the other, or equivalently, the minimum number of errors that could have transformed one string into the other. In a more general context, the Hamming distance is one of several string metrics for measuring the edit distance between two sequences. It is named after the American mathematician Richard Hamming.
A major application is in coding theory, more specifically to block codes, in which the equal-length strings are vectors over a finite field.

The Hamming distance is named after Richard Hamming, who introduced the concept in his fundamental paper on Hamming codes, Error detecting and error correcting codes, in 1950. Hamming weight analysis of bits is used in several disciplines including information theory, coding theory, and cryptography.

It is used in telecommunication to count the number of flipped bits in a fixed-length binary word as an estimate of error, and therefore is sometimes called the signal distance For q-ary strings over an alphabet of size q ≥ 2 the Hamming distance is applied in case of the q-ary symmetric channel, while the Lee distance is used for phase-shift keying or more generally channels susceptible to synchronization errors because the Lee distance accounts for errors of ±1.

- **Usage:**

The symbols may be letters, bits, or decimal digits, among other possibilities. For example, the Hamming distance between:

- "**karolin**" and "**kathrin**" is 3.
- "**karolin**" and "**kerstin**" is 3.
- "**kathrin**" and "**kerstin**" is 4.
- **0000** and **1111** is 4.
- **2173896** and **2233796** is 3.