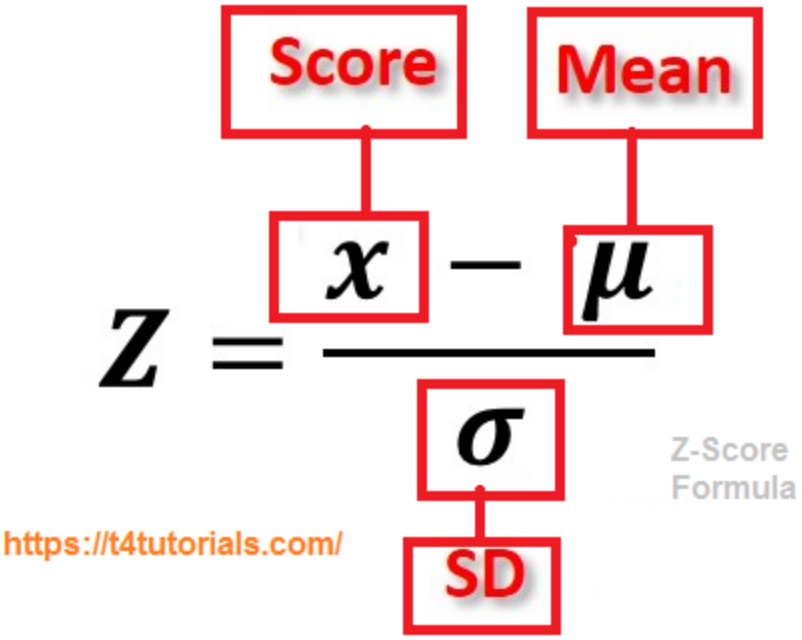
# Z-Score Normalization (Data Mining)



## Z-Score Normalization – (Data Mining)

Z-Score helps in the normalization of data. If we normalize the data into a simpler form with the help of z score normalization, then it's very easy to understand by our brains.

## Z- Scroe Formula



# How to calculate Z-Score of the following data?

| marks |
| --- |
| 8 |
| 10 |
| 15 |
| 20 |

$$s = \sqrt{\frac{\sum(x - \bar{x})^2}{n}}$$



$$\text{Standard deviation} = \sqrt{\frac{\sum(\text{every individual value of marks} - \text{mean of marks})^2}{n}}$$



Mean of marks = 8 + 10 + 15 + 20 /4 = 13.25

$$= \sqrt{\frac{(8 - 13.25)^2 + (10 - 13.25)^2 + (15 - 13.25)^2 + (20 - 13.25)^2}{4}}$$

$$= \sqrt{\frac{(-5.25)^2 + (-3.25)^2 + (1.75)^2 + (6.75)^2}{4}}$$



$$= \sqrt{\frac{27.56 + 10.56 + 3.06 + 45.56}{4}} = \sqrt{\frac{86.74}{4}} = \sqrt{21.6} = 4.6$$

**Figure:** z score normalization standard deviation

**Mean =** 13.25

**Standard deviation =** 5.37

$$ZScore = \frac{x-\mu}{\sigma} = \frac{8-13.25}{4.6} = -1.14$$



$$ZScore = \frac{x-\mu}{\sigma} = \frac{10-13.25}{4.6} = -0.7$$



$$ZScore = \frac{x-\mu}{\sigma} = \frac{15-13.25}{4.6} = 0.3$$

$$ZScore = \frac{x-\mu}{\sigma} = \frac{20-13.25}{4.6} = 1.4$$

**Figure:** z score normalization data mining

| **marks** | marks after z-score normalization |
|---|---|
| 8 | -1.14 |
| 10 | -0.7 |
| 15 | 0.3 |
| 20 | 1.4 |

## Download Excel File Calculations

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F63

| | A | B | C | D | E | F | G | H | I | J |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | https://T4Tutorials.com | | | | | | |
| 2 | | | | | | after z-score normalization | | | | |
| 3 | Id | Depend | Sal | Eucledean | Id | Depend | Norm-Dep | Salary | Norm-Sal | Eucledean |
| 4 | E101 | 3 | 50000 | 0 | E101 | 3 | -0.5287788 | 50000 | 4.2954 | 0 |
| 5 | E105 | 5 | 50000 | 49999.37304 | E110 | 3 | -0.5287788 | 45000 | 3.86583 | 0.4295716 |
| 6 | E110 | 3 | 45000 | 5000 | E113 | 3 | -0.5287788 | 57000 | 4.8968 | 0.6014003 |
| 7 | E113 | 3 | 57000 | 7000 | E114 | 3 | -0.5287788 | 42000 | 3.60809 | 0.6873146 |
| 8 | E111 | 6 | 43000 | 7000.000643 | E112 | 4 | 0.293766 | 39000 | 3.35035 | 1.2528822 |
| 9 | E114 | 3 | 42000 | 8000 | E107 | 3 | -0.5287788 | 35000 | 3.00669 | 1.2887149 |
| 10 | E109 | 5 | 40000 | 10000.0002 | E108 | 4 | 0.293766 | 38000 | 3.26443 | 1.3188946 |
| 11 | E112 | 4 | 39000 | 11000.00005 | E102 | 4 | 0.293766 | 65000 | 5.58412 | 1.5288446 |
| 12 | E108 | 4 | 38000 | 12000.00004 | E104 | 4 | 0.293766 | 35000 | 3.00669 | 1.5288446 |
| 13 | E107 | 3 | 35000 | 15000 | E105 | 5 | 1.1163108 | 50000 | 4.2954 | 1.6450896 |
| 14 | E102 | 4 | 65000 | 15000.00003 | E103 | 3 | -0.5287788 | 70000 | 6.01369 | 1.7182865 |
| 15 | E104 | 4 | 35000 | 15000.00003 | E109 | 5 | 1.1163108 | 40000 | 3.43626 | 1.8559221 |
| 16 | E103 | 3 | 70000 | 20000 | E106 | 1 | -2.1738684 | 30000 | 2.57712 | 2.3788291 |
| 17 | E106 | 1 | 30000 | 20000.0001 | E111 | 6 | 1.9388556 | 43000 | 3.694 | 2.5398625 |

**Figure:** Z Score normalization Excel File Calculations

## How do you use a z score table?

1. We can find a specific area under the normal distribution curve.

2. We can find the z-score of the data value and use a Z-Score Table.

Z-Score Table is used to find the area.

A Z-Score Table shows the area percentage to the left of a given z-score on a standard normal distribution.

## Advantages of the z score

The z-score is very useful when we are understanding the data. Some of the useful facts are mentioned below;

The z-score is a very useful statistic of the data due to the following facts;

It allows a data administrator to understand the probability of a score occurring within the normal distribution of the data.

The z-score enables a data administrator to compare two different scores that are from different normal distributions of the data.

## Is a higher or lower Z score better?

Suppose we have data from two persons. Person A has a high Z score value and person B have low Z Score value. In this case, the higher Z-score indicates that Person A is far away from person B.

## What does a negative and a positive z score mean?

A negative z-score indicates that the data point is below the mean.
A positive z-score indicates that the data point is above the mean.

## Why is the mean of Z scores is 0?

The standard deviation of the z-scores is always 1 and similarly, the mean of the z-scores is always 1.
Z-scores values above the 0 represent that sample values are above the mean.
z-scores values below the 0 represent that sample values are below the mean.
In the case of squared z-scores, the sum of the squared z-scores is always equal to the number of z-score values.

## What is the meaning of the high Z score and low Z score?

- Suppose we have a  high z-score value then it means a very low probability of data above this z-score.
- Suppose we have a low z-score value then it means a very low probability of data below this z-score.

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