How can data be normalized between 0 and 100?

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Data normalization is a process of organizing and standardizing data in a consistent and systematic manner to remove any inconsistencies and improve its accuracy and comparability. One way to normalize data is to scale it between 0 and 100. This involves converting the data values to a range of 0-100, with 0 representing the lowest value and 100 representing the highest value. This can be achieved by using a mathematical formula or by rescaling the data based on the minimum and maximum values. Normalizing data between 0 and 100 allows for better understanding and comparison of the data, as all values are on the same scale. It also makes the data more visually appealing and easier to interpret.

Normalize Data Between 0 and 100

To normalize the values in a dataset to be between 0 and 100, you can use the following formula:

zi = (xi - min(x)) / (max(x) - min(x)) * 100

where:

zi: The ith normalized value in the datasetxi: The ith value in the datasetmin(x): The minimum value in the datasetmax(x): The maximum value in the dataset

For example, suppose we have the following dataset:

Data Values
12
19
21
23
25
35
47
48
59
65
66
67
68

The minimum value in the dataset is 12 and the maximum value is 68.

To normalize the first value of 12, we would apply the formula shared earlier:

zi = (xi - min(x)) / (max(x) - min(x)) * 100 = (12 - 12) / (68 - 12) * 100 = 0

To normalize the second value of 19, we would use the same formula:

zi = (xi - min(x)) / (max(x) - min(x)) * 100 = (19 - 12) / (68 - 12) * 100 = 12.5

To normalize the third value of 21, we would use the

same formula:

zi = (xi - min(x)) / (max(x) - min(x)) * 100 = (21 - 12) / (68 - 12) * 100 = 16.07

We can use this exact same formula to normalize each value in the original dataset to be between 0 and 100:

Data Values	Normalized
12	0
19	12.5
21	16.07
23	19.64
25	23.21
35	41.07
47	62.5
48	64.29
59	83.93
65	94.64
66	96.43
67	98.21
68	100

How to Normalize Data Between Any Range

We can actually use this formula to normalize a dataset between 0 and any number:

where Q is the maximum number you want for your normalized data values.

In the previous example we chose Q to be equal to 100,

but we could easily normalize a range of data values between 0 and 1,000 by choosing Q to be 1,000:

To normalize the first value of 12, we would apply the formula:

zi = (xi - min(x)) / (max(x) - min(x)) * 1,000 = (12 - 12) / (68 - 12) * 100 = 0

To normalize the second value of 19, we would use the same formula:

zi = (xi - min(x)) / (max(x) - min(x)) * 1,000 = (19 - 12) / (68 - 12) * 100 = 125

To normalize the third value of 21, we would use the same formula:

zi = (xi - min(x)) / (max(x) - min(x)) * 1,000 = (21 - 12) / (68 - 12) * 100 = 160.7

We can use this exact same formula to normalize each value in the original dataset to be between 0 and 1,000:

Data Values	Normalized
12	0
19	125
21	160.7
23	196.4
25	232.1
35	410.7
47	625
48	642.9
59	839.3
65	946.4
66	964.3
67	982.1
68	1000

When to Normalize Data

Occasionally we normalize variables when performing some type of analysis in which we have multiple variables that are measured on different scales and we want each of the variables to have the same range.

This prevents one variable from being overly influential, especially if it's measured in different units (i.e. if one variable is measured in inches and another is measured in yards).

It's also worth noting that we used a method known as min-max normalization in this tutorial to normalize the data values.

The two most common normalization methods are as follows:

1. Min-Max Normalization

Objective: Converts each data value to a value between 0 and 100.Formula: New value = (value - min) / (max - min) * 100

2. Mean Normalization

Objective: Scales values such that the mean of all values is 0 and std. dev. is 1. Formula: New value = (value - mean) / (standard deviation)

How to Normalize Data Between 0 and 1
How to Normalize Data in Excel
How to Normalize Data in R
How to Normalize Columns in Python