

# The Weighted Mean and the Median: Takeaways



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## Syntax

- Computing the weighted mean for a distribution `distribution_X` with weights `weights_X` :

```
### Using numpy ###
from numpy import average
weighted_mean_numpy = average(distribution_X, weights = weights_X)

### By coding a function from scratch ###
def weighted_mean(distribution, weights):
    weighted_sum = []
    for mean, weight in zip(distribution, weights):
        weighted_sum.append(mean * weight)

    return sum(weighted_sum) / sum(weights)

weighted_mean_function = weighted_mean(distribution_X, weights_X)
```

- Finding the median for a `Series` :

```
median = Series.median()
```

- Finding the median for any numerical array:

```
from numpy import median
median_numpy = median(array)
```

## Concepts

- When data points bear different weights, we need to compute **the weighted mean**. The formulas for the weighted mean are the same for both samples and populations, with slight differences in notation:

$$\bar{X} = \frac{\sum_{i=1}^n X_i W_i}{\sum_{i=1}^n W_i} = \frac{X_1 W_1 + X_2 W_2 + \dots + X_n W_n}{W_1 + W_2 + \dots + W_n}$$

$$\mu = \frac{\sum_{i=1}^N X_i W_i}{\sum_{i=1}^N W_i} = \frac{X_1 W_1 + X_2 W_2 + \dots + X_N W_N}{W_1 + W_2 + \dots + W_N}$$

- It's difficult to define the median algebraically. To compute the median of an array, we need to:
  - Sort the values in an ascending order.
  - Select the middle value as the median. If the distribution is even-numbered, we select the middle two values, and then compute their mean — the result is the median.
- The median is ideal for:
  - Summarizing numerical distributions that have **outliers**.
  - **Open-ended** distributions.
  - **Ordinal data**.

## Resources

- [An intuitive introduction](#) to the weighted mean.
- [The Wikipedia entry](#) on the weighted mean.
- [The Wikipedia entry](#) on the median.
- Useful documentation:
  - [numpy.average\(\)](#)
  - [Series.median\(\)](#)
  - [numpy.median\(\)](#)



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