

# Measures of Variability: Takeaways

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## Syntax

- Writing a function that returns the range of an array:

```
def find_range(array):  
    return max(array) - min(array)
```

- Writing a function that returns the mean absolute deviation of an array:

```
def mean_absolute_deviation(array):  
    reference_point = sum(array) / len(array)
```

```
    distances = []  
    for value in array:  
        absolute_distance = abs(value - reference_point)  
        distances.append(absolute_distance)
```

```
    return sum(distances) / len(distances)
```

- Finding the variance of an array:

```
### If the the array is a `Series` object ###  
sample_variance = Series.var(ddof = 1)  
population_variance = Series.var(ddof = 0)
```

```
### If the array is not a `Series` object ###  
from numpy import var  
sample_variance = var(a_sample, ddof = 1)  
population_variance = var(a_population, ddof = 0)
```

- Finding the standard deviation of an array:

```
### If the array is a `Series` object ###  
sample_stdev = Series.std(ddof = 1)  
population_stdev = Series.std(ddof = 0)
```

```
### If the array is not a `Series` object ###
```

```
from numpy import std
```

```
sample_stdev = std(a_sample, ddof = 1)
```

```
population_stdev = std(a_population, ddof = 0)
```

## Concepts

- There are many ways we can measure the **variability** of a distribution. These are some of the measures we can use:
  - **The range.**
  - **The mean absolute deviation.**
  - **The variance.**
  - **The standard deviation.**
- Variance and standard deviation are the most used metrics to measure variability. To compute the standard deviation  $\sigma$  and the variance  $\sigma^2$  for a **population**, we can use the formulas:

$$\sigma =$$

$$\sqrt{\frac{\sum_{i=1}^N (x_i - \mu)^2}{N}}$$

$$\sigma^2 = \frac{\sum_{i=1}^N (x_i - \mu)^2}{N}$$

- To compute the standard deviation  $s$  and the variance  $s^2$  for a **sample**, we need to add the **Bessel's correction** to the formulas above:

$$s =$$

$$\sqrt{\frac{\sum_{i=1}^n (x_i - \mu)^2}{n-1}}$$

$$s^2 = \frac{\sum_{i=1}^n (x_i - \mu)^2}{n-1}$$

- **Sample variance**  $s^2$  is the only unbiased estimator we learned about, and it's unbiased only when we sample with replacement.

## Resources

- [An intuitive introduction to variance and standard deviation.](#)

- Useful documentation:

- `numpy.var()`
- `numpy.std()`
- `Series.var()`
- `Series.std()`

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