Z-scores: Takeaways

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Syntax

- Writing a function that converts a value to a z-score:

```
def z_score(value, array, bessel = 0):
    mean = sum(array) / len(array)

    from numpy import std
    st_dev = std(array, ddof = bessel)

    distance = value - mean
    z = distance / st_dev

    return z
```

- Standardizing a `Series` :

```
standardized_distro = Series.apply(
                        lambda x: (x - Series.mean()) /
Series.std()
                        )
```

- Transforming a standardized distribution to a different distribution, with a predefined mean and standard deviation:

```
mean = some_mean
st_dev = some_standard_deviation

standardized_distro = Series.apply(
                        lambda z: z * st_dev + mean
                        )
```

Concepts

- A **z-score** is a number that describes the location of a value within a distribution. Non-zero z-scores (+1, −1.5, +2, −2, etc.) consist of two parts:
    - *A sign*, which indicates whether the value is above or below the mean.
    - *A value*, which indicates the number of standard deviations that a value is away from the mean.
- The z-score of the mean is 0.
- To compute the z-score for a value coming from a population with mean and standard deviation , we can use this formula:

$$\begin{equation} z = \frac{x - \mu}{\sigma} \end{equation}$$

- To compute the z-score for a value coming from a sample with mean and standard deviation , we can use this formula:

$$\begin{equation} z = \frac{x - \bar{x}}{s} \end{equation}$$

- We can **standardize** any distribution by transforming all its values to z-scores. The resulting distribution will have a mean of 0 and a standard deviation of 1. Standardized distributions are often called **standard distributions**.
- Standardization is useful for **comparing values** coming from distributions with different means and standard deviations.
- We can transform any population of z-scores with mean and to a distribution with any mean and any standard deviation by converting each z-score to a value using this formula:

$$ x = z\sigma + \mu $$

- We can transform any sample of z-scores with mean and to a distribution with any mean and any standard deviation by converting each z-score to a value using this formula:

$$ x = zs + \bar{x} $$

Resources

- The `z-score()` function from `scipy.stats.mstats` — useful for standardizing distributions.
- The Wikipedia entry on z-scores.

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