Measures of Position

Objectives

1. Use z-scores to compare data values
2. Determine and interpret percentiles
3. Determine the five-number summary
4. Create a boxpolot of a dataset

z-scores

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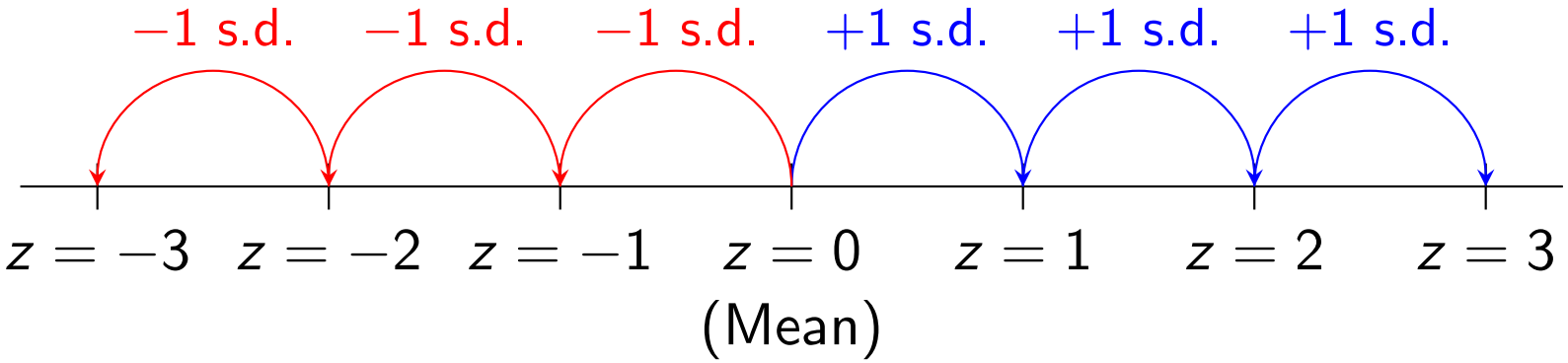
- A positive z-score indicates an above average value.
- A negative z-score indicates a below average value.
- A z-score of 0 indicates an exact average value.

Visual Interpretation of z-Scores



z-Score Formula

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"Usual" data values have z-scores between -2 and 2.

Example 1

The mean SAT score is 1059 with a standard deviation of 210; meanwhile the mean ACT score is 21 with a standard deviation of 5.4. A student takes both tests and receives a 1350 on the SAT and a 29 on the ACT. On which test did the student score better?

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The mean SAT score is 1059 with a standard deviation of 210; meanwhile the mean ACT score is 21 with a standard deviation of 5.4. A student takes both tests and receives a 1350 on the SAT and a 29 on the ACT. On which test did the student score better?

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The student did relatively better on the ACT.

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Percentile Score

A **percentile score** is the percent of data values less than a given value. (*Note*: this is not the same as percentage).

Example 2

For the dataset below, determine the percentile score for the data value 28.

30, 35, 28, 28, 19, 21, 34, 7, 21, 9, 36, 29, 33, 35, 13

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For the dataset below, determine the percentile score for the data value 28.

30, 35, 28, 28, 19, 21, 34, 7, 21, 9, 36, 29, 33, 35, 13

First, sort the dataset:

7, 9, 13, 19, 21, 21, 28, 28, 29, 30, 33, 34, 35, 35, 36

Example 2

For the dataset below, determine the percentile score for the data value 28.

30, 35, 28, 28, 19, 21, 34, 7, 21, 9, 36, 29, 33, 35, 13

First, sort the dataset:

7, 9, 13, 19, 21, 21, 28, 28, 29, 30, 33, 34, 35, 35, 36

There are 6 data values less than 28 in the dataset with 15 values: $6/15 = 40\%$

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For the dataset below, determine the percentile score for the data value 28.

30, 35, 28, 28, 19, 21, 34, 7, 21, 9, 36, 29, 33, 35, 13

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7, 9, 13, 19, 21, 21, 28, 28, 29, 30, 33, 34, 35, 35, 36

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28 is in the 40th percentile.

Methods

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There isn't a universally agreed upon method for finding percentiles.

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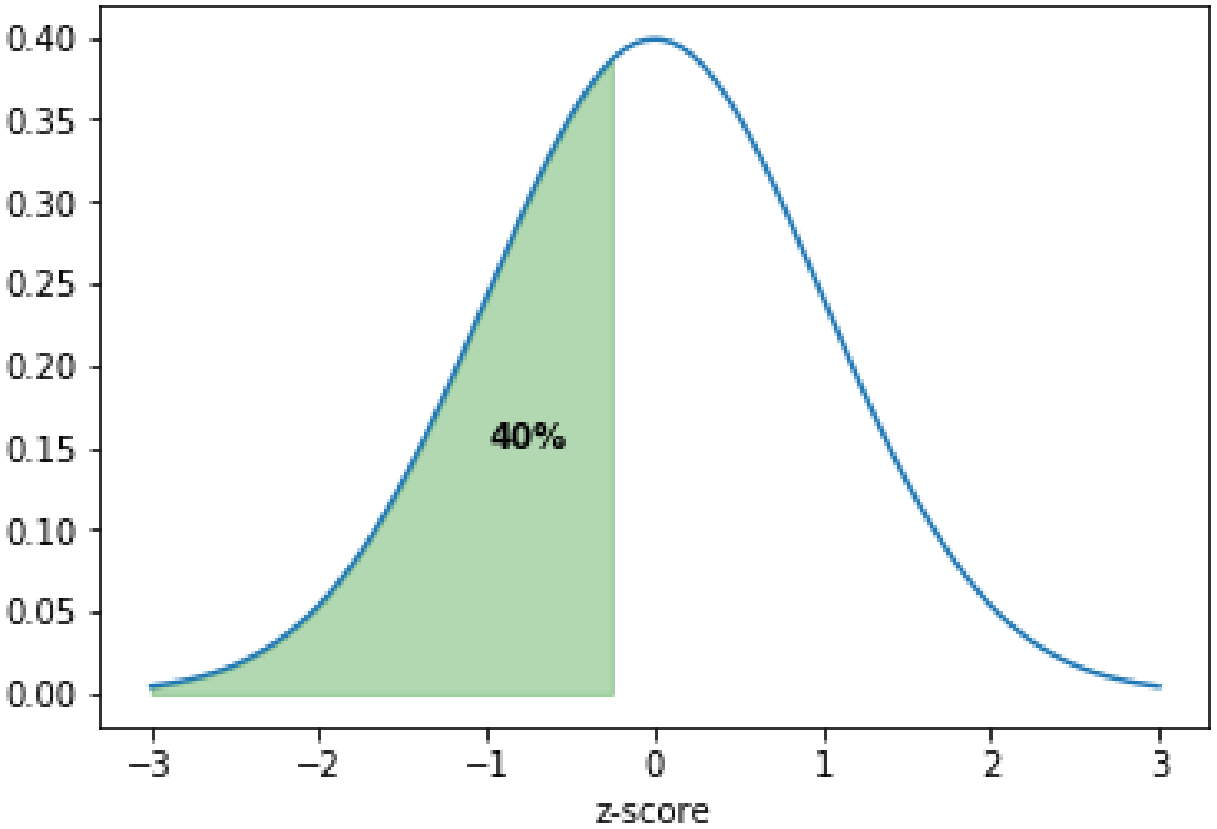
Good News:

Differences in percentile calculations become negligible for larger datasets.

Visualization of Percentiles

Eventually, we will think of being in the 40th percentile as something like the following:



Example 3

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Scoring 90% on the test means you earned 90% of the total available points on the test.

Scoring in the 90th percentile means you did better on the test than 90% of everyone else who took it.

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