Descriptive Statistics - Mean, Median and Mode

Every day at work we meet lists of numbers: sales, prices, waiting times or test scores. Descriptive statistics help us sum up such a list in a few simple numbers. The three best-known measures of the centre, or the typical value, are the mean, the median and the mode. A fourth measure, the range, shows how spread out the numbers are. Knowing which one to use, especially when there are outliers, protects us from wrong conclusions.

1. The Mean

The mean is what most people call the average. We add up all the values and divide the total by how many values there are. Its weakness is that one very large or very small value can pull it a long way.

Example: A family spends 80, 100, 120 and 100 dollars on food over four weeks. To find the mean, they add the four amounts to get 400 and divide by 4. The mean is 100 dollars a week, a good figure for their budget.

At work: Majed, a customer service supervisor, checks five waiting times in minutes: 2, 3, 3, 4 and 13. He calculates the mean: the total is 25 minutes, divided by 5 calls. The mean waiting time is 5 minutes.

2. The Median

The median is the middle value when the numbers are put in order from smallest to largest. About half of the values lie at or below it, and about half at or above it. When there is an even number of values, the median is the mean of the two middle ones. Because it only looks at the middle, the median is hardly affected by extreme values.

Example: Five friends time their trip to work in minutes: 10, 15, 20, 25 and 60. To find the median, they put the times in order and take the middle one. The median is 20 minutes, even though one friend has a very long trip.

At work: Majed puts his waiting times in order: 2, 3, 3, 4 and 13. The median is the middle value, 3 minutes. This is much closer to what a typical caller experiences.

3. The Mode

The mode is the value that appears most often. A list can have one mode, several modes or no mode at all. The mode also works for categories with no natural order, such as colours, where the mean and median cannot be used. It answers the question: what is the most common?

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Example: A shoe shop looks at last month's sales and finds the mode: size 42 sold more than any other size. The shop orders more pairs in size 42.

At work: In Majed's list, 3 minutes appears twice, and every other time appears only once. So the mode is 3 minutes.

4. The Range

The centre is only half of the story; we also need to know how spread out the values are. The simplest measure of spread is the range: the largest value minus the smallest. A small range means the values are close together, and a large range means they vary a lot. Like the mean, the range is easily changed by one extreme value.

Example: In one week, the daily temperature in a city goes from 18 to 30 degrees. The range is 30 minus 18, which is 12 degrees.

At work: Majed calculates the range of his waiting times: 13 minus 2 gives 11 minutes. Such a wide range for short calls tells him that something unusual happened.

5. When Outliers Mislead

An outlier is a value that is far away from the others. It may be a mistake, or a real but rare event. Outliers pull the mean towards them, so the mean may describe almost nobody. In such cases, the median usually gives a fairer picture, and the outlier deserves its own explanation.

Example: Ten people sit in a café, each with a normal salary. When a superstar earning tens of millions a year walks in, the mean income in the room jumps to millions, but the median hardly moves. The median still describes the typical person.

At work: Majed finds that the thirteen-minute call happened during a system failure. He reports a median waiting time of 3 minutes and explains the outlier separately. Management now fixes the system instead of hiring extra staff.

Conclusion

In summary, the mean adds and divides, the median finds the middle, and the mode finds the most common value. The range adds a simple picture of the spread. Before we trust an average, we look for outliers and ask: which measure describes the typical case best? Often the clearest report shows more than one measure.

Sources

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