Khan Academy

Math · Statistics and probability · Summarizing quantitative data · Box and whisker plots

Box plot review

⊞ Google Classroom   Facebook   🐦 Twitter   ✉ Email

What is a box and whisker plot?

A box and whisker plot—also called a box plot—displays the five-number summary of a set of data. The five-number summary is the minimum, first quartile, median, third quartile, and maximum.

In a box plot, we draw a box from the first quartile to the third quartile. A vertical line goes through the box at the median. The whiskers go from each quartile to the minimum or maximum.
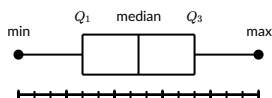
Example: Finding the five-number summary

A sample of 10 boxes of raisins has these weights (in grams):

$25, 28, 29, 29, 30, 34, 35, 35, 37, 38$

Make a box plot of the data.

Step 1: Order the data from smallest to largest.

Our data is already in order.

$25, 28, 29, 29, 30, 34, 35, 35, 37, 38$

Step 2: Find the median.

The median is the mean of the middle two numbers:

$25, 28, 29, 29, 30, 34, 35, 35, 37, 38$

$$\frac{30 + 34}{2} = 32$$

The median is 32.

Step 3: Find the quartiles.

The first quartile is the median of the data points to the *left* of the median.

$25, 28, 29, 29, 30$

$$Q_1 = 29$$

The third quartile is the median of the data points to the *right* of the median.

$34, 35, 35, 37, 38$

$$Q_3 = 35$$

Step 4: Complete the five-number summary by finding the min and the max.

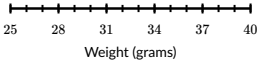The min is the smallest data point, which is 25.

The max is the largest data point, which is 38.

The five-number summary is $25, 29, 32, 35, 38$.

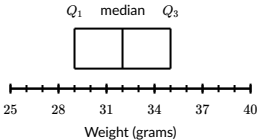## Example (continued): Making a box plot

Let's make a box plot for the same dataset from above.

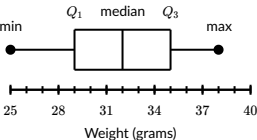**Step 1:** Scale and label an axis that fits the five-number summary.

Step 2: Draw a box from Q_1 to Q_3 with a vertical line through the median.

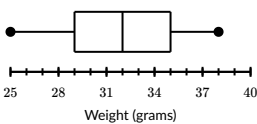Recall that $Q_1 = 29$, the median is 32, and $Q_3 = 35$.

Step 3: Draw a whisker from Q_1 to the min and from Q_3 to the max.

Recall that the min is 25 and the max is 38.

We don't need the labels on the final product:

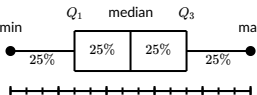*Want to learn more about making box and whisker plots? Check out this video.*

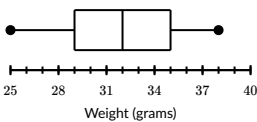*Want to practice making box plots? Check out this exercise.*

Interpreting quartiles

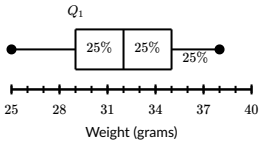The five-number summary divides the data into sections that each contain approximately 25% of the data in that set.

Example: Interpreting quartiles

About what percent of the boxes of raisins weighed more than 29 grams?

Since $Q_1 = 29$, about 25% of data is lower than 29 and about 75% is above is 29.

About 75% of the boxes of raisins weighed more than 29 grams.

Want to learn more about interpreting quartiles? Check out [this video](#).

Want to practice more problems like this? Check out [this exercise](#).

Sort by: Top Voted ⌄

Questions   **Tips & Thanks**

Want to join the conversation?

[Log in]

saul312 4 years ago   more ⌄

How do you find the MAD

Answer • 1 comment   (24 votes) △ Upvote ▽ Downvote ⚑ Flag more ⌄

Muhammad Amaanullah 4 years ago   more ⌄

Step 1: Calculate the mean.
Step 2: Calculate how far away each data point is from the mean using positive distances. These are called absolute deviations.
Step 3: Add those deviations together.
Step 4: Divide the sum by the number of data points.

1 comment   (49 votes) △ Upvote ▽ Downvote ⚑ Flag more ⌄

Nick 2 years ago   more ⌄

how do you find the median,mode,mean,and range please help me on this somebody i'm doom if i don't get this

Answer • Comment   (10 votes) △ Upvote ▽ Downvote ⚑ Flag more ⌄

Maya B 2 years ago   more ⌄

The median is the middle number in the data set.
The mode is the number that shows up the most in the data set.
The mean is the average number of the data set (to find it, you have to add up all of the numbers (sum) and then divide it by how many numbers there are).
The range is the number when you subtract the highest number and the lowest number.
Ex. The highest number in the data set is 10. The lowest number in the data set is 5. To find the range, you would do 10-5, so the range of the data set is 5.

1 comment   (15 votes) △ Upvote ▽ Downvote ⚑ Flag more ⌄

hon 4 years ago   more ⌄

How do you find the mean from the box-plot itself?

Answer • 1 comment   (11 votes) △ Upvote ▽ Downvote ⚑ Flag more ⌄

Maya B 2 years ago   more ⌄

You cannot find the mean from the box plot itself. The information that you get from the box plot is the five number summary, which is the minimum, first quartile, median, third quartile, and maximum.

1 comment   (11 votes) △ Upvote ▽ Downvote ⚑ Flag more ⌄

Alexis Eom 2 years ago

more ⌄

This was a lot of help. Thanks Khan Academy! No question

Answer • Comment   (11 votes) △ Upvote ▽ Downvote ⏴ Flag   more ⌄

Khoa Doan 4 years ago

more ⌄

How should I draw the box plot? Is there a certain way to draw it?

Answer • Comment   (3 votes) △ Upvote ▽ Downvote ⏴ Flag   more ⌄

Anthony Liu 4 years ago

more ⌄

This video from Khan Academy might be helpful.

https://www.khanacademy.org/math/statistics-probability/summarizing-quantitative-data/box-whisker-plots/v/constructing-a-box-and-whisker-plot

Comment   (4 votes) △ Upvote ▽ Downvote ⏴ Flag   more ⌄

See 2 more answers

Yanelie12 4 years ago

more ⌄

How do you fund the mean for numbers with a %.

Answer • Comment   (5 votes) △ Upvote ▽ Downvote ⏴ Flag   more ⌄

bonnie koo a year ago

more ⌄

just change the percent to a ratio, that should work

Comment   (0 votes) △ Upvote ▽ Downvote ⏴ Flag   more ⌄

Jiye 4 years ago

more ⌄

If the median is a number from the actual dataset then do you include that number when looking for Q1 and Q3 or do you exclude it and then find the median of the left and right numbers in the set?

Answer • Comment   (2 votes) △ Upvote ▽ Downvote ⏴ Flag   more ⌄

Jem O'Toole 3 years ago

more ⌄

If the median is a number from the data set, it gets excluded when you calculate the Q1 and Q3. If the median is not a number from the data set and is instead the average of the two middle numbers, the lower middle number is used for the Q1 and the upper middle number is used for the Q3. :)

Comment   (5 votes) △ Upvote ▽ Downvote ⏴ Flag   more ⌄

See 1 more answer

Ozzie a year ago

more ⌄

Hey, I had a question. So, when you have the box plot but didn't sort out the data, how do you set up the proportion to find the percentage (not percentile). For example, take this question: "What percent of the students in class 2 scored between a 65 and an 85?"

Answer • Comment   (2 votes) △ Upvote ▽ Downvote ⏴ Flag   more ⌄

OJBear a year ago

more ⌄

Ok so I'll try to explain it without a diagram

The space between the lowest value and quartile 1 is 25% or 1/4. Quartile 1 to the median is another 25% making it 50% so far. The median to the 3rd quartile is *another* 25% and the 3rd quartile to the highest value if obviously 25% more. So that's 100%.

If 65 is the lowest value and 85 is between the lowest value and quartile 1, then 25% of the students in class scored between 65 and 85. If 65 and 85 go through the lowest value to quartile 1 and to the median then that would be 50%.

I hope this helps? I would need the diagram to explain it better though. I think the Interpreting Quartiles section of the article will explain it better with the visual.

Note: If you ever come across a question with the mean of a box plot, just say there is none. It's impossible to calculate the mean since we don't

have all the data; only parts of it. You can estimate the mean, but not calculate it exactly.

Again, hopes this helps :-)

2 comments   (2 votes)   △ Upvote   ▽ Downvote   ⚑ Flag   more ⌄

Srikar K 3 years ago   more ⌄

Finding the M.A.D is really long!

Answer • **1 comment**   (2 votes)   △ Upvote   ▽ Downvote   ⚑ Flag   more ⌄

> **OliviaObioma** 3 years ago   more ⌄
>
> *I know, right, and MAD stands for Mean Absolute Deviation! Not MADRID! Just saying, cray cray, agreed? @srikark*
>
> Comment   (2 votes)   △ Upvote   ▽ Downvote   ⚑ Flag   more ⌄

samarthjoshi 2 years ago   more ⌄

how to find the lower quartile and upper quartile when there are 10 numbers ?

Answer • Comment   (1 vote)   △ Upvote   ▽ Downvote   ⚑ Flag   more ⌄

> **loumast17** 2 years ago   more ⌄
>
> You basically take the median 3 times any time you find the quartiles. Before anything else make sure your list of numbers is in ascending order tough, this is super important.
>
> First is the plain old median, or the second quartile. With 10 numbers this winds up being a new number between or equal to the fifth and sixth number. Basically take the average (or mean) of the fifth and sixth number.
>
> Now you have the dataset cut in half and you want to look at those halves. Again, can't stress this enough. Important it is all in ascending order.
>
> First the one with the first through fifth number, so on the left side of the median. Take the median again. Since there are five it is just the third number. This is the first quartile.
>
> Next do the same with the other half, so the third quartile is the eighth number.
>
> So to summarize, when you have 10 numbers in ascending order the first quartile is the third number and the third quartile is the eighth nuber. Using the method I showed though will find you the quartiles for any list of numbers in ascending order.
>
> Comment   (2 votes)   △ Upvote   ▽ Downvote   ⚑ Flag   more ⌄

Show more...