Hi. This tutorial covers range and interquartile range. So let's start with this situation. So between the dates of December 24, 2010 and July 1, 2012, the Powerball has paid out 20 jackpots to winners. So the Powerball is a lottery game where you buy a ticket for $1. And if you guess five balls and the Powerball, which is the sixth ball, if you get all of them right, you end up winning the jackpot. And the longer it takes for somebody to win the jackpot, the bigger the jackpot becomes.

So the amount of each jackpot is listed below in millions of dollars. So we have 20 data values here. The first value here, this 48, means that one person who won the jackpot won $48 million. The next person won $122 million and so forth. So we can take a look at all 20 of those values.

So remember, we always like to organize and summarize our data. So I have done that. So here are both what we call the five number summary and the box plot of the jackpot data. So recall that the five number summary consists of the min, Q1, the median, Q3, and the max or the maximum. And here is that same data displayed as a box plot. So we have minimum, Q1, median, Q3, maximum. And we have our scale listed here. So this is quantified here and then graphically displayed here.

Another thing that's useful for the data is to measure how much variation there is in the data. So two measures of variation that can be used to quantify the spread in this distribution are the range and the interquartile range. Sometimes interquartile ranges the abbreviated IQR. So the two formulas, the range is pretty simple. All you do is you take the maximum value, subtract the minimum value. So you take the greatest value, subtract the least value. The IQR, you just subtract quartile 3 and quartile 1, so Q3 minus Q1.

So let's go ahead and calculate both of those from our data set. So if we look at the range, so we want the range first. So if you go back to our data, the range is the max minus the min. So let's go quickly and scan for the minimum. And the minimum here is $25 million, which is still a lot of money, but it's the minimum of this data set. And our maximum here is 336.

So what we want to do to calculate the range is take our maximum, 336, and subtract our minimum, 25. So if we end up doing that, 336 minus 25, we end up with a range of $311 million.

OK, and now let's also do the IQR. So the IQR comes from our quartiles. Our quartiles were calculated ahead of time. So those come from our five number summary, Q1 and Q3. So Q1 was 60, and Q3 was 211. So we want to subtract those two values. So we do 211 minus 60. And again, going to the calculator, 211 minus 60 ends up being 151, so $151 million.

OK, so now to interpret both of those values, what the range does is the range gives you the length of the data's box plot. And then, from the last page there, remember, the range was 311. And the IQR, which was 151, gives the length of the box portion of the data's box plot.

So if we go back and look at the box plot, the range tells me that the range of values spanned $311 million. So from the biggest to the smallest, we end up with 311. So that's one way to quantify the spread.

The other calculation we made was the IQR. The IQR measures the length of the box, just that middle 50%. And that value, again, was 151. So that means that 50% of our values span $151 million. So both of those are ways of measuring how spread out the data is.

Now, a couple of things about the range and the IQR is that the range is very sensitive to extreme values, as well as skew. So basically, if you were to change the maximum or the minimum by just a small amount, your range is going to change. So because it only includes two values and it is those extreme values, if we make an out outlier larger, that's going to increase the range. If we make it smaller, it's going to decrease the range.

Whereas the IQR is resistant to extreme values and skew. So in this case, if we change one of our extreme values, our maximum or our minimum, that will really have no effect on our IQR. So that doesn't change Q1 or Q3, so any change to an extreme value won't really affect the IQR.

So if we think about actually changing our maximum, so if the maximum value, which was 336, is changed 300, what happens to the range and the IQR. OK, so what happens is now our range is going to be 300 minus 25, which is 275. That's down from 311. So that's a pretty big change there. And our IQR-- now, again, Q1 and Q3 are not dependent on that maximum. So our IQR is going to stay the same.

So the range goes down. The IQR stays the same. So oftentimes, when there is an outlier in a data set, oftentimes, we want to use the IQR to measure our spread instead of the range. So that has been the tutorial on range and IQR. Thanks for watching.