

2.1 The Range

Given a collection of data the range is simply the smallest number subtracted from the largest. The range is thus a *measure of spread*.

In its favour, the range is simple to calculate.

Unfortunately it is easily fooled by what are termed *outliers*.

2.2 Example

Here are three groups of exam %age marks.

(i) For each, calculate the range.

Group 1 : 40 41 45 47 53 55 57

Group 2 : 33 35 43 47 50 53 54

Group 3 : 37 61 62 63 63 64 64

(ii) Group 3 contains an outlier.
State which number is the outlier.

(iii) Explain why the outlier has caused the range statistic to not give a true measure of spread in group 3.

2.3 The Interquartile Range: The IQR

In order to overcome the problems that the range has with outliers we need a better measure of spread. Consider the following data;

12 38 40 44 45 48 51

In essence, we throw away some data from the bottom and some from the top. In this case, as there are not many numbers, we'll just throw away the lowest and the highest item of data. What's then left is;

38 40 44 45 48

The 38 is referred to as the lower quartile, LQ, and the 48 as the upper quartile, UQ.

The interquartile range is then the range of what is left.

Thus, the IQR for the seven items of data is $UQ - LQ =$

Here is how to calculate the interquartile range in a more mathematical way.

Recall that the data is;

12 38 40 44 45 48 51

Step 1 : Count up how many items of data there are.
In this case 7.

Step 2 : Add 1. (Mindlessly accept that you always add 1 for now!)
So in this case we now have 8.

Step 3 : Divide by 4.
Thus the LQ is piece of data in position 2 from the left, which is 38.
And the UQ is piece of data in position 2 from the right, which is 48.

Step 4 : $IQR = UQ - LQ$
Which, in this case gives 10.

2.4 Exercise

Question 1

Consider the following data;

22 48 52 53 57 62 63 71 72 72 75 77 86 89 91

- Calculate
- (i) The lower quartile.
 - (ii) The upper quartile.
 - (iii) The interquartile range.

Question 2

Calculate the interquartile range of the following data;

31 43 45 46 49 50 54 55 58 62 63 63 66 66 68 73 75 92 100

Question 3

Consider the following data;

73 44 67 64 63 45 45

- (i) Put the data in order.

- (ii) Calculate the interquartile range of the (ordered) data.

Question 4

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There are 15 students in class A.

In a test, the students gained these marks.

2 1 2 5 5 6 9 2 5 6 7 5 6 5 6

Find the interquartile range of these marks.

Question 5

In an IQ test, nine adult males scored as follows

123 89 112 105 74 118 96 101 93

Put the IQ scores in order and then calculate;

- (i) The lower quartile.

- (ii) The upper quartile.

- (iii) The interquartile range.

Question 6

In English, it is helpful to have a 'reading age' that provides a teacher with an idea of how difficult a book, paragraph or sentence is to read.

SENTENCE A : *It is hypothesized that sentences containing substantial variation in word length are difficult to read.*

SENTENCE B : *Are these words extraordinarily easy to read ?*

The number of letters in each of the words of sentence A are;

2 2 12 4 9 10 11 9 2 4 6 3 9 2 4

- (a) Calculate the range of the word letter lengths in Sentence A.

- (b) Calculate the range of the word letter lengths in Sentence B.

- (c) Which sentence does the range statistic predict is easier to read ?
Explain your answer.

- (d) Calculate the interquartile range of the word lengths of sentence A.

- (e) Calculate the interquartile range of the word lengths of sentence B.

- (f) Which sentence does the interquartile range predict is easier to read ?
Explain your answer.

- (g) What other factors might need to be taken into account when trying to calculate a 'reading age' of a sentence ?