

KNOWLEDGE CHECK

42

UPPER AND LOWER QUANTILES

This question also refers to the pupils and data described in Knowledge Check 41. For these pupils the lower and upper quartiles for scores I in the mathematics test were found to be 54 and 65 respectively. Decide which of the following statements must be true for these particular pupils in relation to the mathematics basic skills test.

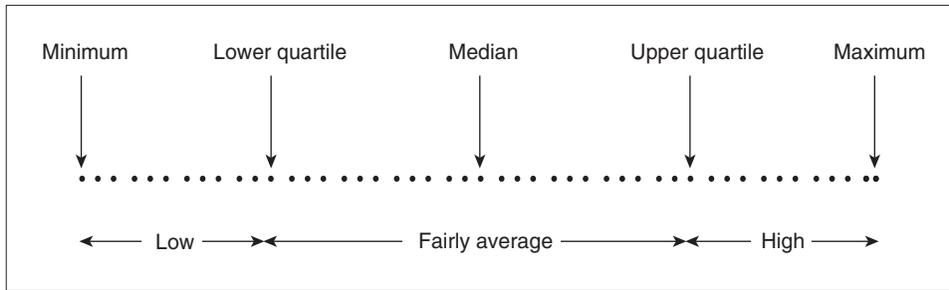
- A The scores of the middle 49 of these pupils were in the range from 54 to 65.
- B The scores of all 99 pupils were in the range from 54 to 65.
- C A pupil with a score of 66 would have scored higher than at least 74 other pupils.
- D A pupil with a score of 64 would be in the top quarter of the cohort.
- E A pupil with a score of 52 would be in the bottom quarter of the cohort.

ANSWERS TO KNOWLEDGE CHECK 42

A, C and E must be true.

DISCUSSION AND EXPLANATION OF KNOWLEDGE CHECK 42

Quartiles are a simple extension of the idea of a median. Having lined up all the data in the set in order from smallest to largest, as well as identifying the one in the middle as the median, we identify the value a quarter of the way along the line as the *lower quartile* (LQ), and the value three-quarters of the way along the line as the *upper quartile* (UQ). So, the lower quartile, the median and the upper quartile divide the whole set into four quarters. Loosely speaking, we can think of the bottom quarter as being ‘low’, the top quarter as ‘high’, and the middle half as ‘fairly average’:



Using the heights of pupils in a year group as an example: those we might refer to as ‘short’ would have heights less than the LQ; those we might consider ‘tall’ would have heights greater than the UQ; and those of medium height, not especially short or tall, would lie in the range from the LQ to the UQ. If there were 15 items of data in a set, when the items are arranged in order, the LQ, the median and the UQ would be the 4th, 8th and 12th values. But, in practice you should not worry too much about how you would decide precisely where the lower and upper quartiles would be. Just think of them as being a quarter and three-quarters of the way along the list of data. These measures should only be used with fairly large sets of data anyway – and your main requirement will be to interpret these statistics rather than to find them.

So, in this check-up, knowing that the LQ and UQ are respectively 54 and 65 allows us to use these as reference points to identify whether a pupil has scored low, fairly average, or high, in relation to the others in the group. A score of 66 is above the UQ, putting this pupil in the ‘high’

group, or the top 25%. This score must exceed the scores of at least 75% of the pupils. At the other end, a score of 52 is below the LQ, putting this pupil in the 'low' group or the bottom 25%. This score must be exceeded by at least 75% of the pupils. A score of 64 is between the two quartiles, putting this pupil in the middle 50% of the whole group. In knowledge check 42 we saw that this score of 64 is 'above average' in the sense that it is greater than the median. Reference to the quartiles allows us to go further and say something like 'above average but not in the top 25%'.

SUMMARY OF KEY IDEAS

- For a (large) set of numerical data arranged in numerical order from lowest to highest, the lower quartile (LQ) is the value of the item a quarter of the way along the list, and the upper quartile (UQ) is the value of the item three-quarters of the way along the list.
- A value higher than the UQ is greater than at least 75% of the items in the set.
- A value lower than the LQ is less than at least 75% of the items in the set.
- We can think of the LQ and UQ as dividing the set into three sections: 'low' (the bottom 25%), 'high' (the top 25%) and 'fairly average' (the middle 50%).



FURTHER PRACTICE

- 42.1 (This question is an extension of Further Practice question 41.1.) In that particular year, in English non-selective schools with more than 50% of pupils known to be eligible for free school meals, the LQ, median and UQ for the percentages of pupils achieving grade 4–9 for GCSE mathematics were 12, 18 and 25 respectively. What does this mean for a school with 52% of pupils eligible for FSM and 28% of their pupils achieving grade 4 or above in GCSE mathematics? What about another school with 52% FSM, but with only 15% of pupils achieving grade 4 or above in GCSE mathematics?
- 42.2 (This question is an extension of Further Practice question 41.2.) Data for all primary schools indicates that the LQ, median and UQ percentages of the Year 3 teaching week devoted to English are 22.2%, 25.0% and 28.1%. St Anne's Primary School devotes 22.1% of the Year 3 teaching week to English. What does this tell us about St Anne's? What about St Michael's School, that devotes 30% of its Year 3 teaching week to English?