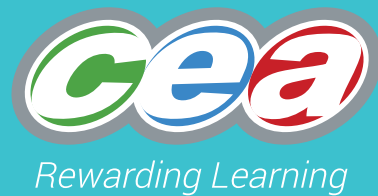


GCSE



# Chief Examiner's Report Statistics

Summer Series 2023





## Foreword

This booklet outlines the performance of candidates in all aspects of this specification for the Summer 2023 series.

CCEA hopes that the Chief Examiner's and/or Principal Moderator's report(s) will be viewed as a helpful and constructive medium to further support teachers and the learning process.

This booklet forms part of the suite of support materials for the specification. Further materials are available from the specification's microsite on our website at [www.ccea.org.uk](http://www.ccea.org.uk).



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# GCSE STATISTICS

## Chief Examiner's Report

### General

For Summer 2023, we saw a return to normal assessment arrangements for candidates cashing in for the first time. Advance Information was provided for both units at each tier of entry.

The standard of answering in some parts of each paper was excellent and many candidates gave a very good account of their statistical knowledge, understanding and skills. Examiners reported some truly outstanding work by candidates, particularly in the Higher Tier papers. Responses to questions requiring extended writing continue to be an area for improvement across all of the papers, but it must be acknowledged that the standard of answering was better in 2023 than in previous series. There was some evidence that many candidates were unfamiliar with some standard statistical terminology relating, in particular, to sampling and data collection and this prevented access to marks on many occasions. A further set of past examination papers, which this series provides, will hopefully give future candidates additional exposure to the range of types of question which can appear and provide opportunities to practise these as part of their preparations.

It is pleasing to note that there was no evidence of timing issues in any of the papers so candidates are managing their time well to get the paper completed in the allocated time.

In both tiers of Unit 2, some candidates appear to be unfamiliar with any of the pre-release materials. A number of these graphs and tables are not familiar and would be challenging to see for the first time under examination conditions. An in-depth knowledge of the pre-release materials is not needed, but candidates should at least be able to read from the graphs and tables.

### Assessment Unit 1

### Foundation Tier

Candidates performed well in this paper with some excellent scripts seen by examiners. It is clear that candidates are very comfortable with certain topics from the specification and that they find others difficult. In this unit, questions on probability and box plots were not well answered and, as in other units, knowledge of standard definitions and vocabulary was weak. It is noteworthy that those candidates who knew standard definitions also answered well across other questions in the paper.

- Q1** This was a straightforward opening question in which the vast majority of candidates gained most or all of the marks. A small number of candidates calculated relative frequencies in the final column which was not required.
- Q2** This question was well answered by most candidates. Practically every candidate got the correct answers to Parts (a) and (b), though a few lost marks in Part (c) for either an inaccurate bar or no labelling. Part (d) was well answered, though surprisingly some candidates compared days other than Monday and Thursday.
- Q3** With the exception of a few candidates who were not familiar with frequency trees, Part (a) was very well answered. However, many candidates were unable to arrive at the correct probability for Part (b). A common incorrect answer was  $\frac{23}{48}$ , indicating that these candidates did not know to find the grand total first. Quite a number of candidates gave probabilities which exceeded 1.

- Q4** This was a fairly routine question on sampling procedures, which those candidates who were familiar with the terminology listed in the specification were able to answer with no issue. It was clear from a lot of candidates' scripts that they had not learned key vocabulary and were unable to gain any of the marks for Parts (a) to (d). In Part (f), many candidates were able to follow the instructions to select the correct sampling units and gain full marks. Some were unprepared for this part, merely selecting the first five numbers from the list even though the first one was outside the required range.
- Q5** Unfortunately, many candidates were unable to find the mean from this frequency table. Some did multiply the individual scores and frequencies, and a subset of these did find the correct total frequency but were unable to make any further progress. Many candidates, even those who had calculated the correct total frequency, divided by six here. For the range, a lot of candidates got an answer of 9 from  $11 - 2$ , which was the difference in the largest and smallest numbers from any row in the table. Part (b) was fairly well answered with the only major error being the omission of the 7 pupils who scored exactly 7 marks and therefore did not pass the test. Answers to Part (c) were good.
- Q6** Calculating the sizes of the angles and drawing the pie chart were very well done by most candidates, apart from those who did not have a calculator or a protractor (or both) and some inaccuracy with drawing the angles. A few did not label the sectors. In Part (b), only a small proportion of the candidates were able to identify that Eamon was referring to the number of residents rather than the number of properties.
- Q7** As in other places on this paper, it was rare to see correct responses to Part (a), indicating that standard definitions had not been learned. Nevertheless, candidates were able to engage with the context and correctly identify an advantage and a disadvantage in Part (b) and some very good contextual responses were seen here. In Part (c), it was difficult to determine which candidates knew that the skewness shown was negative and which ones guessed the answer. This was because some candidates got the second mark for correctly describing the skewness in the graph but identified it as positive. From their descriptions, it was clear that a lot of candidates understand skewness as a 'tendency towards' rather than 'straying from'. In Part (d), it was surprising how many candidates were not able to give the modal class for the vans, even though the corresponding value for cars had been given in the question, though explanations in Part (d)(iii) were good.
- Q8** For full marks in Part (a), candidates needed to plot the double mean point and draw a line of best fit through it. However, the double mean point is not well understood. Candidates are plotting it but then drawing lines of best fit which do not pass through it. Descriptions and interpretations in Part (b) were very good. Similarly, answers to Part (c), which required an understanding of extrapolation, were of a high standard.
- Q9** Many candidates made fairly good attempts in this question about risk. The percentages in Part (a) were mostly correct, though some inexplicably multiplied by 100 twice. Parts (b) and (c) were well answered but there was more variation in part (c), particularly among those who did not know how to answer Part (a), though this could have been answered independently. Answers to Part (d) were mostly good.



**Q10** Candidates found most parts of this question difficult. Part (a) was more challenging than expected, with many unable to find the median or the upper quartile (even though the lower quartile was given). Very few knew how to find the interquartile range in Part (b) and examiners saw all sorts of approaches from adding the lower and upper quartiles to dividing the range by two. Part (c) was not well answered, even by those who got Part (b) correct. For Part (d), it was surprising how many candidates did not realise that there was no mode as each value in the table appeared only once, and similarly in Part (e), quite a few candidates did not know what an outlier was. Drawing the box plot in Part (f) was more successful for some candidates although, there was some evidence that candidates were not familiar with box plots at all so they were unable to complete the comparisons in Part (g). However, those who attempted this part were usually able to get some of the marks available.

## Assessment Unit 1 Higher Tier

In general, candidates responded well to this paper. They were well prepared to answer questions on a wide range of topics and examiners reported seeing some outstanding scripts. It is clear that candidates are much more comfortable with questions involving routine methods and applications compared to contextual interpretation (AO2) or evaluation (AO3) of results and/or methods.

- Q1** The majority of candidates scored well in this accessible opening question. The main issue was in Part (a), in which about two-thirds of candidates selected the incorrect response. It should be noted that a more uniform spread of frequencies within similar-sized datasets will usually imply more variation.
- Q2** Responses to this question on sampling methods exposed a lack of deep understanding of this topic. Only about half of the candidates got both marks in Part (a), though the vast majority got Part (b) correct. Many candidates simply did not know what cluster sampling was and, as a result, it was rare for all four marks to be awarded here. Even those who did know what it was found it difficult to apply the method in the context of this question. In Part (d), it was surprising how many candidates suggested improvements which would have involved additional sampling when the question ruled this possibility out. However, there were some excellent responses to Parts (c) and (d) from some very able candidates.
- Q3** This question was well answered by most candidates and certainly more marks were awarded here than in the same question on the Foundation Tier paper. Percentage calculations were well done and most candidates did show working to support their answers. Quite a few struggled to give an explanation as to why the number of faulty computers may differ, with many merely pointing out that the answer to Part (c) was an estimate.
- Q4** Most candidates fared well in this question and responses were markedly different from those on the Foundation Tier paper. Most parts of the question involved application of fairly routine methods and candidates had learned these well. Part (c) was not well answered as the candidates tended to explain how to calculate the interquartile range rather than explaining what it meant. Surprisingly, quite a number of candidates did not know what an outlier was so struggled with Part (e). Part (g) differentiated well between candidates, with some providing full responses but others merely stating values with no attempt to compare them.

- Q5** The method of quality assurance sampling is well known by candidates and the vast majority did well in this question. Some answers to Part (c) were vague and only the most able noticed that while the sample means were all within the tolerances set on the chart, all of them exceeded the sample mean – something which would require further investigation.
- Q6** It was clear that most candidates had some knowledge of how to calculate a weighted mean, so the majority were able to gain some marks in this question. Part (a) was fairly well done but some were unable to articulate a correct reason for Part (a). Calculations were mostly fine in Part (b) but where a decision is required, like it was here, it must be explicitly stated. Quite a number of candidates worked out 74% but did not go on to state that this meant Geri had got a grade A. Reversing the weighted average calculation in Part (c) proved very challenging for many candidates, though it was encouraging to see some well-presented responses here. Candidates should be aware that credit is available for partially correct solutions (as stated on the front of the examination paper) so should be encouraged to write down supporting calculations.
- Q7** For most candidates at Higher Tier, this fairly routine question was well done. Calculation of the mean in Part (b) was good, though there were a few errors such as some using  $n = 5$  instead of totalling the frequencies. Part (c) was correctly done by the most able candidates but many scored no marks in this part. Some good answers to Part (d) were seen but many seemed to not be able to compare values and interpret the comparisons, which this question required.
- Q8** For those who attempted this question, answers to Part (b) were much better than Part (a) so even those candidates who knew how to apply the capture/recapture method in Part (b) found it difficult to justify in Part (a). A common issue in Part (a) was stating the same assumption more than once using different wording. However, it was notable how many candidates did not know how to do either part of this question.
- Q9** Quite a number of candidates were unable to make any progress with this question. Common issues included: finding  $d$  by subtracting scores rather than ranks, inconsistent ranking, incorrect approach to tied ranks (the mean rank should be used), negative values of  $d^2$ , incorrect substitution and reading the formula as  $\frac{1 - 6\sum d^2}{n(n^2 - 1)}$ .

Interpretation in Part (b) and the follow-up in Part (c) were not well done, even by those who got Part (a) correct. The magnitude of  $r_s$  in this case could not be used to defend a positive correlation.

- Q10** Knowledge of the normal distribution as a model was better in this paper than in similar questions in previous series, though candidates do find this topic difficult. Having said this, a sizeable proportion of candidates were still unable to access many marks in this question. For those who attempted them, Part (a) yielded many more correct responses than Part (b). The routine calculation in Part (c) was the most successful part of the question for most, but many made no progress beyond calculating a standardised score in Part (d).

## Assessment Unit 2

## Foundation Tier

While candidates tended to find this paper more challenging than Unit 1, many performed very well in it and demonstrated really good knowledge of the specification. Some candidates appeared to be unfamiliar with the pre-release materials as they were unable to answer the questions directly related to them, but those who were familiar with them answered these questions very well.

- Q1** This question examined a chart taken from the pre-release materials. Some lost marks here, even in Part (a) as they quoted 46 from the chart rather than 46,000 and many left out the units. Other parts were answered reasonably well by most candidates, though a few identified the frequency of the mode rather than naming the category in Part (c)(i).
- Q2** Most candidates found this question very accessible and were able to achieve almost all of the marks available. An exception to this was in Part (a) where only a small number of candidates were able to name the method.
- Q3** The pie chart in this question came directly from the pre-release materials and candidates fared better here than in Question 1. It was somewhat surprising how many could not give a suitable reason for the sum of the percentages exceeding 100 in Part (b). The percentage calculation in Part (c) was generally good, as were answers to Part (d). Candidates should note that a conclusion must be stated in questions such as Part (d), i.e., that they either agree or disagree with the statement, rather than just the reason.
- Q4** Candidates found this question challenging and, apart from the more able, many could not gain more than a few marks. Hardly any candidates were able to give a full description of selecting a systematic sample in Part (a), though answers to this part and to Parts (b) and (c) did suggest that they knew what it was. In Part (d), quite a number of candidates did not arrange the numbers in order (or at least the first six of them) and so were unable to find the median and quartiles. There was some evidence of  $\frac{1}{4}$  and  $\frac{3}{4}$  in many scripts but with no subsequent work. Some found the mean and range here. Candidates did not answer Part (e) well and many merely listed values with no attempt to compare them.
- Q5** In this question, candidates needed to know some vocabulary from the specification and many simply did not know it. Responses to the Venn diagram question in Part (e) varied considerably. Some got the correct answer to Part (e)(i) but did not use it in Part (e)(ii) and some knew how to complete the diagram in Part (e)(ii) but had answered Part (e)(i) incorrectly, indicating that they may not have known what the intersection of the circles actually represented.
- Q6** This question addressed parts of the statistical enquiry cycle in the context of data which appeared in the pre-release materials. However, some candidates were unable to understand the problem. The hypotheses in Part (a) were fine for those who did understand the problem, but many stated questions here and were unable to identify the correct data in Part (b) or indeed a suitable source in Part (c). This meant that Parts (d) and (e) were only accessible to the most able, so this question differentiated well between the candidates.
- Q7** The concepts of risk and expected frequency were well understood in general and candidates made a good attempt at each part in this question. Part (b) uncovered a few issues with percentages but Parts (a) and (c) were well done.

- Q8** The earlier parts of this question were fairly routine and candidates were able to answer Parts (a), (b) and, to a lesser extent, Part (c), though a few did not draw the warning line on the chart. Most candidates made a reasonable attempt in Part (c) but full answers were rare. In this situation, candidates should recognise that a further sample needs to be taken immediately and not at the next scheduled time. Candidates struggled with the more hypothetical nature of Parts (d) and (e) and the impact the adjustments would have on the process, which suggested an uneasy understanding of this topic beyond the routine tasks as required in Parts (a) and (b).
- Q9** The graph in this question appeared in the pre-release materials. Unfortunately, many candidates found it very difficult to read from this graph even though examiners gave some leeway owing to the absence of gridlines. This made Part (a) inaccessible to many other than the most able candidates. Candidates articulated the trends in Part (b) fairly well and demonstrated good command of this topic, though accounting for the difference in the trends proved more challenging. Very few candidates could calculate the product moment correlation coefficient in Part (d) and they should be reminded that this is to be done by calculator and no formula will be given for it. For Part (e), the more able candidates were able to identify the positive correlation by eye from the table and without recourse to the correct answer in Part (d).

## Assessment Unit 2 Higher Tier

This paper proved a little more demanding than its Unit 1 counterpart, though many candidates performed very well in it and fully correct responses to all items on the paper were seen frequently. There was no issue with timing and candidates did appear to be able to manage their time sufficiently well to complete the paper within the allocated time. Some questions related directly to information in the pre-release materials and those candidates who were familiar with them did fare better in these questions. The standard of answering was noticeably better in the second half of the paper, even in some very challenging questions.

- Q1** This opening question was based on a table taken directly from the pre-release materials and Parts (a) and (c) were well answered. However, it was surprising how many candidates were unable to suggest a suitable reason in Part (b) to account for the difference in the numbers and, similarly, quite a few candidates made very general comments in Part (d) which were unrelated to the numbers in the categories.
- Q2** Answers to this question on planning and data collection varied quite a bit. Parts (a) and (b), which required knowledge of the terms *population* and *sampling frame*, were only answered correctly by a minority of candidates and such technical terms appear not to be well known, in this question and elsewhere on the paper. This was also the case in Part (c), where many posed a question.
- Q3** Responses to this question were better on this paper than in the parallel question on the Foundation Tier paper. The mechanistic aspects of the topic of quality assurance are well known, and some good answers to Parts (a) to (c) were seen, though sometimes answers to Part (c) lacked detail and the warning line was omitted in Part (a). The evaluative nature to Parts (d) and (e) indicated that candidates were much less comfortable with this type of question so answers lacked detail and were often unconvincing. Candidates should understand the reasons for quality assurance sampling in the first place and how different approaches may achieve different outcomes.

- Q4** Again, this question appeared on the papers at both tiers of entry and candidates at this tier responded better. It was, however, surprising how many candidates were unable to read the required numbers from the graph to find the mean for Part (a). Later parts of this question were well answered and many were able to demonstrate what the graph in the question actually illustrated.
- Q5** It was pleasing to see how well probability was understood by the candidates. Parts (b) and (c) were well answered, though unfortunately quite a number of candidates wrote probabilities in the diagram in Part (a) instead of frequencies. The decision making and reasoning in Part (d) were well done, and most gave a good reason in Part (e).
- Q6** Venn diagrams were well understood by the vast majority of candidates so Part (a) and the probability in Part (b) were well answered. Conditional probability was problematic for all but the most able candidates, with many scoring 0 in Part (c). The concept of expectation was well understood so good answers were seen in Part (d).
- Q7** This question differentiated well between the candidates on this paper as some coped well with this question whereas others appeared to have little understanding of cumulative frequency. Even some very strong candidates did not check the upper class boundaries systematically when plotting the points in Part (d), as many made an error at 210 because of the unequal class widths. Identifying the median and quartiles in Part (e) was very good for those who knew how to draw the cumulative frequency diagram. Candidates did make valiant attempts at comparisons in Part (f), but they must understand that a comparison requires more than stating values: they must explicitly say which is larger (or smaller) or that they are the same, and this must be done in context. However, the standard of answers to Part (f) was noticeably better than in similar questions in previous series.
- Q8** Use of the binomial distribution as a model was well done by practically all candidates, and Parts (a) and (b) were answered correctly on the majority of scripts. Use of the binomial expansion in Part (c) was only done well by the most able candidates. Unsurprisingly, more were successful with Part (c)(i) as many were unable to formulate a strategy for dealing with 'at least once'. Some were able to select the correct term(s) but either did not know the relationship between  $p$  and  $q$  or could not cope with the substitution, or both. It was very pleasing to see some fully correct answers to both parts of (c) with these candidates showing an excellent command of this topic and of the requisite mathematics.
- Q9** This question was inspired by information from the pre-release materials. Candidates showed a very good grasp of how to work with chain base index numbers and answers to Parts (a) and (b) were very good. The interpretation of the meaning of a chain base index number in Part (c) was less well done, even by those who had Parts (a) and (b) fully correct. Interpretation must be done in context, so candidates who present a general comment on what index numbers show are unable to get any credit as the responses must refer directly to the value in Part (b).
- Q10** This question centred on standardised scores and the majority of it was only accessible to the most able candidates. Accordingly, it differentiated between candidates at top end of the ability scale. Most candidates were able to get the mark in Part (a) but very few were able to calculate the standard deviation in Part (b), with quite a few trying to use the formula for a frequency distribution (which is given on page 2 of the paper). Correct answers to Part (c) were rare although, some did demonstrate an understanding of how to calculate a standardised score, even if they were unable to use the result. As with Question 8, there were some outstanding responses to this question.

## **Assessment Unit 3**

## **Controlled Assessment**

There were no entries for this Unit in Summer 2023.

## Contact details

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