

GCSE



Chief Examiner's Report Statistics

Summer Series 2024



Foreword

This booklet outlines the performance of candidates in all aspects of this specification for the Summer 2024 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.

Contents

Assessment Unit 1	Foundation Tier	4
Assessment Unit 1	Higher Tier	6
Assessment Unit 2	Foundation Tier	9
Assessment Unit 2	Higher Tier	11
Contact details		13

GCSE STATISTICS

Chief Examiner's Report

Subject Overview

In this series, we ran a further full set of papers for each tier and unit. It is encouraging to acknowledge the continued popularity of the GCSE Statistics specification in centres given the continued healthy number of candidates. Teachers are to be commended for high levels of thorough preparation of their students which was evident in the examination papers and for giving them a firm grounding in statistics which this specification is designed to provide.

It is very pleasing to note that candidates are presenting themselves well prepared for each paper. Examiners continue to report on candidates' excellent knowledge in applying standard statistical techniques to familiar contexts and the manner in which these techniques are conveyed in the papers.

There continues to be some room for improvement in responses to questions requiring interpretation of information, including in context, at both tiers of entry. In particular, candidates should be aware that any interpretation should be supported by the statistical evidence available, even if this seems somewhat 'obvious'. In addition, it must be stressed that the evidence quoted has to show how it supports the conclusion, rather than be a mere re-statement with no understanding shown.

Example A

There appears to be no correlation between X and Y since the value of r is 0.105

Example B

There appears to be no correlation between X and Y since the value of r is close to 0.

In Example A, while there appears to be evidence to support the conclusion, it is not the actual value of r which suggests no correlation but rather the fact that it is close to zero. This is why Example B is preferable.

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, it continues to be the case that some candidates appear to be unfamiliar with any of the pre-release materials. A number of these graphs and tables are novel in nature and would be challenging to see for the first time under examination conditions. It must be reiterated that an in-depth knowledge of the pre-release materials is not needed, nor is a knowledge of the particular context, but candidates should at least be able to read from the graphs and tables efficiently.

Assessment Unit 1

Foundation Tier

Unit Overview

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 answered well across other questions in the paper.

- Q1** Rewriting tallies as frequencies presented little difficulty in Part (a), and the vast majority of candidates were able to draw the required pictogram correctly in Part (b). In Part (c), most candidates were able to get one of the marks for noting that the tick symbol was not symmetrical but much fewer went on to get the second mark for stating why this was a problem.
- Q2** Candidates scored well in this question with most noting the missing value in cell B5 and the ambiguous 'B' in cell A8. Some did not spot the anomalous height of 15.1 metres in cell C3. It was good to see candidates use correct cell referencing in this question.
- Q3** Practically every candidate identified the correct outlier in Part (a), and calculation of the mean and range in Part (b) and Part (c) were equally well done. In Part (b), some candidates rounded 10.2 to 10 unnecessarily. Comparisons in Part (d) varied considerably in quality. Candidates must be aware that a comparison must be more than two statements: they must be linked. For example, a lot of candidates simply stated that Adam's range was 5 and Callum's range was 3 yet, this information was already provided in the question. To get the mark, they needed to say that Adam's range was greater than Callum's (or an equivalent comparison) as one being greater than the other is what is noteworthy, not their individual values. Very few candidates were able to note that a smaller range implied more consistency in times.
- Q4** The scatter diagram was identified correctly in Part (a) by nearly every candidate, but many did not correctly identify the explanatory variable in Part (b). Some candidates noted that the explanatory variable was the independent variable, but this is not what the question asked. Knowledge of the terms explanatory variable, response variable, independent variable and dependent variable are all required for this specification. While most candidates did correctly identify the negative correlation in Part (c) it was surprising how many described the correlation as positive. Part (d) and Part (e) were answered correctly by approximately 50% and 25% respectively of the candidature, so it is not obvious whether these responses were known or guessed!
- Q5** Part (a) of this question was well done and candidates appear to be well prepared for this type of question as the standard of response was better than in similar questions in previous series. This was also the case in Part (b), though responses were not as convincing in several cases as some candidates gave the same reason twice.

- Q6** A surprising number of candidates were unable to state an appropriate hypothesis in Part (a) and many wrote a question here. For this specification, a hypothesis is simply a statement about the variable(s) in the investigation. Language relating to formal hypothesis testing for population parameters (such as H_0 or H_1) is not required. Most candidates got at least one of the two available marks in Part (b), but fewer were able to justify the use of a compound percentage bar chart in preference to a simple bar chart in Part (c), with some simply stating what a compound percentage bar chart shows. It was disappointing to note how many candidates did not know how to draw a compound percentage bar chart for Part (d), though most did correctly calculate that 25% of the passengers had single tickets. As Part (d) was poorly answered, many struggled with Part (e) and Part (f), but those who did them did so reasonably well, particularly Part (f). In Part (g), cluster sampling was identified correctly by more than half of the candidates, who either knew that this was correct or were able to rule out the other possibility. Responses to Part (h) were good, with many correctly identifying the sources of bias.
- Q7** Apart from a small number of arithmetical errors, completion of the two-way table in Part (a) was excellent. However, it was clear that many candidates simply did not know what a risk was for Part (b) and were unable to extract the correct numbers from the table. Some tried to divide 3110 by 255 so appeared to know which numbers to use but did not know what to do with them. Very few were able to express the risk in the form 1 in n for Part (b)(iii). Part (c) was answered well in general, though it was clear again that the concept of a risk was not known to many candidates as they simply did not know what to do with the numbers in the question. Several candidates tried to take values from the table on the previous page, which was not necessary.
- Q8** Part (a) was done well and it was good to note that candidates were able to interpret the probabilities in this Venn diagram correctly. Part (b) was less well done with many incorrectly including 0.14 in the calculation. Many candidates were unable to correctly describe the meaning of intersection of the Venn diagram and practically every combination of full-time, part-time, working from home and not working from home was seen here. Attempts at Part (d) were good with candidates opting to use 0.56 on its own or both 0.14 and 0.42 separately to work this out. Several just used 0.42 only.
- Q9** Attempts at this question were generally weak and there was evidence that many candidates were not familiar with cumulative frequency at all. This question appeared on the Higher Tier paper as well, where attempts were much stronger. Of those who did attempt it, Part (a) was not always answered correctly with 6 and 185 seen frequently. Attempts at the median were sometimes good, but this was often quoted as 30, though attempts at the interquartile range were rarely correct. This made it difficult for those other than the strongest candidates to draw the box plot in Part (c). Hardly any candidates were able to link the shape of the box plot to a justification for the use of a normal distribution model in Part (d).
- Q10** This question was also common to the Higher Tier paper, but attempts were generally better here than for Question 9. Part (a) and Part (b)(i) were good and it was encouraging to note the improvement in the standard of answers to this topic than to questions on previous papers. Part (b)(ii) was not always done correctly as candidates tended to rely on what they perceived to be the general trend in the numbers in the table rather than simply noting that the index number for 2020 was less than 100. Answers to Part (c) and Part (d) were only given by the strongest candidates, but they should be reminded that full marks in questions like this can only be awarded where sufficient mathematical justification is given.

Assessment Unit 1

Higher Tier

Unit Overview

Overall, this was a successful paper covering a wide range of topics which allowed strong candidates to demonstrate their ability and knowledge at this level. The full range of abilities was catered for as demonstrated by the standard of answering and marks gained.

In general, the standard of responses was good with the expected range of ability levels in evidence.

Most questions were completed or at least attempted by the majority of candidates. There were plenty of questions which discriminated well between candidates but also plenty of questions which were accessible to all.

- Q1** The majority of candidates were able to gain full marks for a fully correct stem and leaf diagram in Part (a), though some forgot to include a key. For Part (b), most candidates were able to find the median but the even number of scores caused candidates difficulty when working out the interquartile range. All parts of Part (c) were very well answered, demonstrating good understanding of the effect of missing data on averages and measures of spread.
- Q2** In Part (a), candidates understood the difference between a census and sample but omitted the conclusion that the data from a census would be more reliable. Part (b) was well answered in general; however, consistent with previous series, a minority of candidates believe it is unsuitable to ever ask closed questions in a survey. In Part (c), few candidates were able to identify that stratification allows proportions within the population to be preserved in the sample. Part (d) was well answered overall; most candidates were at least able to form the fraction of people who were over 60 years old.
- Q3** A surprising number of candidates did not get the mark in Part (a) as they summed the cumulative frequency readings for all the data points rather than just reading the cumulative frequency from the last data point. Part (b) was better answered with most candidates able to both identify the median and work out the interquartile range using suitable readings from the graph. There were good responses overall by candidates in Part (c), most of whom were able to correctly calculate the maximum data point and proceed to accurately plot the median and quartiles worked out in Part (b) in the form of a box plot. A wide range of responses was seen in Part (d); some candidates were aware of symmetry/lack of skew as a condition for applying the normal distribution. Some described the distribution as evenly distributed which was not accepted as an alternative answer.
- Q4** Most candidates were able to identify that the data was secondary and quantitative in Part (a). In Part (b), the majority of candidates were able to identify that the cost of the streaming service decreased but were unable to identify the reason why, i.e. the index number for 2020 was less than 100. Part (c) was well answered by candidates; several alternative approaches were observed such as utilising a reverse percentage method. Part (d) was well attempted in general. Some candidates observed from the table that £1 corresponded to 1.9% and worked from there to the correct final answer.

- Q5** Practically all candidates answered Part (a) correctly. Part (b) was well done too, though it was noted that some candidates seemed to think that a probability could not be expressed as a vulgar fraction and converted their final answers into either a decimal or a percentage for Part (b)(i) and Part (b)(ii). Part (b)(ii) was generally well answered although some did not realise that three numbers from the Venn diagram needed to be identified and then summed instead of just identifying a single number from the Venn diagram. Part (c) was well attempted; a common wrong answer was from candidates who were able to identify 12 ($9 + 3$) as the numerator of their fraction but used 65 as the denominator.
- Q6** Answers to Part (a) were overwhelmingly excellent with many candidates scoring full marks for correctly working out the missing frequency and for completing the histogram correctly. A small number attempted to calculate an estimate of the mean, which the question did not require. In Part (b), while most candidates recognised that the sample may not be representative of the entire population, a sizable minority of them then concluded that Hugh was incorrect. There was perhaps an assumption by candidates that Hugh's statement had to be either correct or incorrect rather than concluding that we cannot be sure, indicating an underlying discomfort with uncertainty. Several candidates used the fact that the data was in groups to justify their conclusion, but this was not correct.
- Q7** Responses to Part (a) were correct from practically every candidate. Many candidates correctly calculated Spearman's rank correlation coefficient and achieved full marks in Part (b)(i), though some did not get the final mark as they had not rounded their final answer to 3 decimal places. In Part (b)(ii), many candidates correctly concluded that there was unlikely to be any correlation between the number of visitors to the cinema and the average ticket price while omitting to support their conclusion by observing that the value of r_s was close to zero. Quite a few candidates incorrectly concluded that because $r_s > 0$ there was weak positive correlation, suggesting a commonly observed tendency for candidates to conclude that there must be either positive or negative correlation rather than zero correlation.
- Q8** Both Part (a) and Part (b) were very well answered with many candidates able to achieve full marks. However, very few candidates were successful in Part (c) as the majority calculated the arithmetic mean rather than the geometric mean as required. Many candidates were able to earn one mark in Part (d) for stating the correct percentage increase but were unable to earn the second mark for stating that the percentage increase was over the five-year period. Only the strongest candidates were able to make any meaningful progress in Part (e). A commonly observed incorrect answer was to work out the three index numbers and then find the arithmetic mean of these numbers rather than the weighted mean.

- Q9** A variety of responses were observed in Part (a). A small number of candidates worked out the boundaries as ‘target weight ± 1.2 ’ rather than ‘mean ± 1.2 ’. The majority of candidates earned 1 mark in Part (b) for sketching a symmetrical bell-shaped curve peaking at 64.2 though few were able to earn the second mark by showing the tails of the curve coming down close to the axis at 60.6 and 67.8 respectively. Part (c) was not well answered in general. A number of candidates attempted to use a method based on $1.5 \times \text{IQR}$, which was inappropriate for this question, rather than the desired Mean $\pm 3\text{SD}$ method. Most candidates correctly calculated the mean in Part (d)(i) given the summary statistics, but while a lot correctly substituted the summary statistics into the provided formula for Part (d)(ii), many seemed unable to apply the correct order of operations in their calculators. A wide variety of responses was observed in Part (e). Many candidates correctly concluded that Machine B’s mean was closer to the target weight than Machine A but failed to make any valid observations about the standard deviations of the machines and therefore were unable to earn the final mark for concluding that Machine B was more reliable.
- Q10** Many candidates were able to calculate the correct probability for Part (a). While very few were able to provide two correct reasons why the binomial distribution could be a suitable model to use in Part (b)(i), the majority were able to identify $n = 5$ and $p = 0.56$ from the information given. Part (c) and Part (d) were only done well by the strongest candidates. Relatively few were able to identify the correct pair of terms required to calculate the desired probability for Part (c) and fewer again were able to make any progress with Part (d).

Assessment Unit 2

Foundation Tier

Unit Overview

As in 2023, candidates appeared to find this paper more challenging than the Unit 1 Foundation Tier paper, perhaps due to the relatively greater weight given to AO3 in this unit. Candidates are more confident with topics which appear in GCSE Mathematics but less confident with topics such as index numbers and the product moment correlation coefficient. In addition, 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** Part (a) and Part (b) were answered well by the vast majority of candidates, though some appeared not to understand the meaning of the word consecutive. Part (c) was well done by most, but several candidates either did not order the values or calculated the mean instead. Most were able to find the range in Part (d) with the only error being the subtraction of the values for 2009 and 2021 rather than the greatest and least values during this period. Part (e) was answered well but Part (f) was not as many candidates did not note that the vertical axis began at 4000. Some chose to estimate the percentage fall in consumption using the actual values and showing that this was not 25%.
- Q2** Candidates found this question very accessible with most gaining all or almost all of the available marks. Apart from arithmetical issues when completing the table, the main difficulty was identifying the required information from the table for Part (d).
- Q3** The diagram in this question came directly from the pre-release materials. Part (b) was well answered but candidates would have offered better responses to Part (a) and Part (c) if they had worked through the pre-release materials. There appeared to be a lack of understanding of what connections were.
- Q4** In this question which addressed data collection, candidates scored well in Part (a) to Part (d) and demonstrated good understanding of primary data and closed questions. Similarly, scores were good in Part (e) to Part (g) for those who knew about census data.
- Q5** Responses to Part (a) and Part (b) were disappointing and candidates did not know what a sampling frame was or what cluster sampling is. A surprising number chose the incorrect response in Part (c) showing that they probably did not know what either diagram looked like. Part (d) was fine, though many could not write down the correct modal class for Part (e). Very few were able to give a comprehensive response to Part (f), though more were able to get one of the two available marks. Several candidates commented on the sampling method for Part (g) rather than how the data was collected. Similarly, responses to Part (h) tended to focus on sampling.
- Q6** Although many did not know that the index number for the base year was 100 in Part (a), they were able to interpret the numbers in the table to obtain the marks in Part (b) and Part (c). A good number were able to identify an appropriate type of graph for Part (d), though there were several who clearly did not know what certain types of graphs show.

- Q7** It was encouraging to note strong performances in this question which addressed several components of the statistical enquiry cycle. Part (a) and Part (b) were well done but several did not realise that there may be an issue with representativeness when using one class to make a decision about a whole year group. The back-to-back stem and leaf diagram was very well done but a small number forgot to include one or both keys. Responses to Part (f) were good, with the exception of Part (f)(ii) which was frequently incorrect.
- Q8** Most candidates made an attempt to define a time series with a vague reference to time, but found it difficult to do this succinctly. The reading was correctly taken for Part (b) but many could not draw a trend line for Part (c), with some leaving it out and others drawing a zigzag which did not show a trend. Nevertheless, most were able to describe the decreasing trend in Part (d), though most could not identify the correct assumption for Part (e).
- Q9** Although most calculated the mean correctly for Part (a)(i), it was surprising to note how many were unable to identify the correct council area for Part (a)(ii). Knowledge of how to calculate and interpret the product moment correlation coefficient required for Part (b), Part (e) and Part (f) was only demonstrated by the strongest candidates at this tier. In Part (c) and Part (d)(i), candidates plotted the points correctly and were able to identify the outlier.

Assessment Unit 2

Higher Tier

Unit Overview

This examination paper was designed to assess a range of skills and understanding, covering key topics typically encountered at this level. The paper included a balanced mix of questions, from basic to more challenging problems, ensuring a comprehensive evaluation of candidates' abilities. Overall, candidates responded well to the questions posed and fully correct solutions to every part were seen. However, questions requiring interpretation, justification and/or evaluation tend to be less well answered and candidates appear to find it difficult to express themselves in succinct, relevant language.

- Q1** The stimulus for this question was taken from the pre-release materials so it will have been familiar to candidates. Answers were mostly very good, though in Part (c) some did not appreciate that the percentages in the chart gave no information about the actual amount of electricity.
- Q2** Answers to this fairly standard question were good, with most noting the three issues with the chart. However, a small number gave the same reason twice.
- Q3** Responses to the stem and leaf diagram in Part (a) were excellent, with the only issues being the omission of one or both keys or part of the stem for which there were no leaves. In Part (b), candidates found it difficult to explain what the lower quartile meant in context, though most were able to go on to find the upper quartile in Part (c). Part (d) was not well answered and many candidates seemed unaware of a formal method to identify outliers.
- Q4** Candidates found it difficult to explain in straightforward terms what a time series was. Part (b) to Part (d) were well done, though many described the fluctuations in Part (d) rather than the trend. This meant that there were not many who identified the correct assumption in Part (e).
- Q5** This question was common to this paper and the Unit 2 Foundation Tier paper and candidates on the Higher Tier paper fared much better. Part (a) to Part (d) were answered well, though, as before, candidates found it difficult to answer in context in Part (b) and Part (d)(ii). Calculation of the product moment correlation coefficient for Part (e) was significantly better at this tier.
- Q6** Index numbers were well understood and the calculations in Part (c) were particularly well done. Where interpretation in context was required in Part (a), Part (b) and Part (d), candidates were less confident here. In particular, many candidates chose to describe the year-to-year change in Part (d) rather than the overall pattern as required by the question.
- Q7** Part (a) and Part (b) were generally well done but some candidates' work suffered unduly from premature rounding. The question required a whole number which some candidates missed. Part (c) was successfully attempted by the very strongest candidates and there was some evidence that candidates had not seen this topic before. Responses to Part (d) and Part (e) based on risk varied between full understanding and manipulating the values given in the question to get the required 4 but with little understanding shown. However, the interpretation in Part (e) was largely successful.

- Q8** This fairly routine question on time series caused some issues for many candidates with only the strongest being able to access all of the marks. Many did not know how to calculate a moving average and some trend lines were not straight. Part (e) which required candidates to take a reading from their trend line for what the next moving average would be was only attempted by the strongest candidates. Some just used their line to predict the value for Quarter 1 of 2019. In addition, some candidates increased their workload by trying to work out the seasonal variations for Quarter 1 and adding the mean seasonal variation to the value indicated by the trend line for Quarter 1 of 2019. While this method, if correctly used, will be credited appropriately, seasonal variations are not included in this specification so an approach based on moving averages is suggested.
- Q9** Candidates made good attempts at this question and their responses indicated a fairly good knowledge of correlation. As elsewhere in the paper, it was common for responses to be a little unclear in places and not directly answering the question posed. For example, in Part (b) candidates had to comment on how the scatter diagrams had been drawn rather than what they showed. In Part (c), most were able to identify the positive correlation between both pairs of variables but many did not identify the stronger correlation between the marks in Mathematics and Science. Calculations in Part (d) were good whereas sometimes the justification to which equation should be used was unconvincing.
- Q10** Part (a) of this question was fairly well done by most apart from a few who drew a histogram or plotted the frequencies against the upper class boundaries. Some did not label the axes. Most candidates were successful in being able to estimate the mean from the table but many were unable to make much, if any, progress in estimating the median. Those who were successful used several equivalent and acceptable methods. It was frustrating to note that, having successfully estimated the mean and median, several candidates did not go on to use their values to decide which was more appropriate.

Contact details

The following information provides contact details for key staff members:

- **Specification Support Officer: Nuala Tierney**
(telephone: (028) 9590 6689, email: ntierney@ccea.org.uk)
- **Officer with Subject Responsibility: Gavin Graham**
(telephone: (028) 9590 6658, email: ggraham@ccea.org.uk)



INVESTORS
IN PEOPLE

