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Principal Examiner Feedback

Summer 2013

GCSE Statistics (5ST1H)
Paper 01

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GCSE Statistics 5ST1H
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Introduction

Candidates generally had time to attempt all questions.

On the whole candidates seemed well prepared for the demands of this specification. Now in its third year, teachers have adapted their teaching to meet the requirements of the specification and candidates found this paper comparable in difficulty to last year's. It was pleasing to see that candidates are generally making good attempts at making deductions and drawing conclusions. Poor clarity of expression remains an issue for a number of candidates, often resulting from not reading questions carefully enough. In questions where candidates are asked to make comparisons between two values, many are simply stating the two values rather than using comparative language e.g. '…which is less than…'.

Candidates should be encouraged to show their working. This includes drawing lines on diagrams to show where values have been read off. This will help increase accuracy, particularly on questions with more complex scales.

A small number of candidates incorrectly give probabilities as a ratio. Only fractions, decimals or percentages are allowable.

When comparing distributions this should be done using a correct average, measure of spread and direction of skew. For questions that assess the quality of written communication (QWC, marked with *), candidates should be aware that correct statistical language is expected. Where more than one mark is available for a question, candidates should be aware that the number of marks generally indicates the number of comments expected.

Report on individual questions

Question 1

This question was an accessible start to the paper with part (c) proving to be more discerning. Virtually all candidates attempted part (a) with very few not scoring both marks. The most common incorrect answer was to see 41 in place of 14 which could have been the result of adding the figures 31 and 10 above or reversing the digits. It was rarer to see the 65 or 74 wrongly evaluated.

Part (b)(i) was answered correctly by virtually all candidates. In (b)(ii) most candidates were able to select correct figures on which to base the probability for the member chosen to be a junior. Candidates who wrote $\frac{24}{120}$ sometimes incorrectly cancelled this fraction, since this is not part of the assessment objective this was not penalised. Candidates however should be encouraged to write unsimplified fractions first before attempting to simplify them. A small minority continue to present the

answer in a ratio form, '24:120', which is not an acceptable format for a probability nor is '24 out of 120' though this is now rarely seen.

Many candidates were able to select the correct figures for the conditional probability in (c), though some candidates still give 120 as the denominator. If written as a decimal, probabilities should be given to at least 2 decimal places. Common incorrect answers were $\frac{55}{120}$, $\frac{10}{120}$ and $\frac{10}{24}$.

Question 2

This was a fairly straightforward question and a good source of marks for most candidates. Candidates are confident in reading information from tables in part (a) and (b).

In part (c) candidates did very well, with the majority achieving full marks. A small number of candidates made arithmetic errors whilst others attempted to average the four figures rather than simply totaling them. The vast majority of candidates gained this mark in (d), even those who had incorrect figures in (c). Most candidates said that the percentage had increased and gave a figure based on their previous answer. A few candidates commented on the share being about $\frac{3}{4}$ of the total in both years.

Question 3

This question challenged candidates to express themselves clearly, in particular parts (a) and (e). Quite a few candidates gave short or ambiguous answers with insufficient explanation for example they would state "unreliable" but without an explanation as to why. Also "easier" needed further explanation to gain a mark (i.e. easier to collect data, therefore faster). The majority of candidates were able to gain at least 1 mark in part (a). The most common answers were quicker (to collect lots of data) and cheaper as advantages. More able candidates discussed avoiding interview bias as an advantage. Candidates found choosing a disadvantage harder, often stating bias, unfair, lack of honesty or inability to expand on answers as a disadvantage rather than stating the need to explain questions or non-response. A lot of students seemed to rely on stock answers like 'too expensive' and 'takes too long'.

In (b) most were able to give at least one of the required responses. A large number of candidates stated that the question was closed and only had yes/no answers possible when in fact it is an open question. Common answers scoring only 1 mark were to give 'biased' and 'leading' as two separate reasons. Some candidates went off on tangents about the public having no idea how much money had been spent, not being interested, not using the theatre etc.

A few students misread part (c) writing a general question about the use of car parking or the theatre rather than the cost. Whilst most candidates appreciate the requirement of non-overlapping response boxes, it was quite common to see misused inequality signs e.g. £3 ≤ £ 5 or £3 ≤ x > £5. Time frames and units should be included in the question or the response boxes.

As in previous years part (d) was a well answered question. A small minority of candidates incorrectly opted to give advantages about a pilot study instead.

Candidates were generally successful with part (e) though many contradictory responses were given e.g. 'It is a good sample since it is random, but it is a bad sample as only people in the telephone directory can participate'. The most popular answers were associated with the small sample size and not everyone being in the telephone directory.

Question 4

The majority of candidates were able to gain the mark in part (a) for explaining that the raw data is not known or mid-points were used. Part (b) was much less successful. Most candidates failed to earn the mark only stating that the mean would increase, but very few appreciated that it would increase by £10.

Question 5

Candidates should notice that 2 marks were available in part (a). Most candidates were able gain one of these for a qualitative comparison e.g. 'an increase'. However, many did not go on to explain the significance of the index number 112. Some candidates demonstrated they did not understand index numbers commenting with incorrect answers of 'it has gone up by 12' or 'it's 112 higher than before'. A significant number of blank responses were seen showing that this is an area that candidates still find difficult.

The most successful candidates used one step to solve the problem i.e. 1.23×14000. Some candidates were not secure with finding a percentage and used methods such as a building up (e.g. find 10%, 1% and then use multiples of these), generally with varied success. There were a fair number of misreads where candidates used the index number for 2004 from part (a) instead of 2006.

Question 6

Part (a) was a successfully answered question with the majority of candidates being awarded the mark. Most are fully aware of the need to give a relevant hypothesis, in this case about books, in the form of a statement. Only a significant minority still posed their hypothesis as a question.

Far too many candidates ignored the information that Jenny is going to use a simple random sample and described various other sampling methods in (b), usually stratified/systematic sampling (another case of failing to read the question correctly). Those candidates who realised what was required scored reasonably well. Generally marks were awarded for numbering and most described the use of a suitable random number generator. However the idea of matching the numbers to the corresponding students was often vague or omitted entirely. Choosing names/numbers out of a hat is not appropriate for such a large population. Candidates should have experience of identifying a relevant statistical problem having completed a controlled assessment and successful responses discussed what to do with repeated numbers or participant's non-response. Many tried to explain that their methods, such as writing everyone's name on a piece of paper, would consume too much time.

A large proportion of candidates correctly identified stratified sampling in part (c)(i). Part (c)(ii) was well attempted with many candidates correctly calculating the correct proportion of male second year students. A substantial number of candidates failed to fully read the question though, only stratifying by one category rather than two. As a result, the most common incorrect answer seen was 18. A small number found the percentage (multiplying by 100 instead of the required sample size of 40).

Question 7

Candidates performed well on this question. On very few occasions some students had graphed the 2 categories in part (a) at the correct number but did not shade the standard chicken curry bar. Candidates should take care when reading scales on graphs as the most common error seen was with the 12 being plotted at 14.

Parts (b) and (c) posed very little difficulty for the majority of candidates.

In (d) most gained the mark for a comment about standard chicken having a higher %RDA for saturates with the second mark for supporting figures being the one more commonly lost. Occasionally the supporting figures were incorrect due to misreading the scale e.g. 52% was often seen instead of 62%. Others went on to compare the %RDA for all nutritional contents. Candidates should avoid using 'whereas' for a comparison when stating two figures.

Question 8

Many candidates struggled to identify quarters 2 and 3 in the year 2007 as the successive quarters with the biggest change in the mean in part (a).

The majority of candidates could correctly describe the trend in (b) however a number described the correlation rather than the trend and a smaller number described the individual points of the time series rather than the trend line. Still too many candidates stated negative correlation/negative skew although some then rescued themselves with a further description.

Most candidates attempted part (c) and gained the mark. However a considerable number of candidates transposed the last two digits, giving the answer as 21.59. Some lost the mark failing to give the answer to an appropriate degree of accuracy as required from the scale of the graph, usually 21.9 or 22.

Part (d) was very poorly dealt with by most candidates who often misinterpreted the question. The first mark was the more likely mark for candidates to achieve. Most who scored this mark did so by stating that their answer would be higher. Candidates who attempted but failed to score the second mark did so generally because they described an overall pattern rather than discussing the significance of the 4^{th} quarter. There was a general lack of understanding of seasonal variation and very few candidates referred to this in their answer.

Question 9

Most candidates were able to gain at least one mark for their Venn diagram in part (a) usually for placing the 5 correctly in the centre. Failure to subtract meant that progress was limited for some and it was fairly common to see 20 and 40 instead of 15 and 35. Even more common was to see the region outside the two circles left blank. A significant minority of candidates used tally marks or crosses instead of figures in the diagram.

Even if the Venn diagram was incorrectly drawn the information provided in the question meant that the mark in (b)(i) was still available. The most common incorrect answer was $\frac{55}{100}$. In (b)(ii) candidates were able to select the correct region of their Venn diagram and consequently this part was often more successfully answered than (b)(i). This was a well answered part with many candidates clearly demonstrating an understanding of the region 'on time and from Europe'.

Again part (c) was well answered with many candidates using the figures of 5 and 20 given in the third line of the question. It was less common for candidates to answer this using an incorrect Venn diagram, despite a follow through method mark being available to them. Yet several candidates were unable to recognise the conditional probability here and simply wrote the most common incorrect answer of $\frac{5}{100}\frac{\Delta y}{\Delta x}$.

Question 10

This question allowed most candidates to pick up a few marks and gave the opportunity for the most able candidates to excel. Virtually all candidates can identify the median from a box plot and part (a) was extremely successful. Again higher tier candidates are confident at finding the IQR from a box plot and apart from some misreads of the scale, most were able to score 2 marks in part (b).

The majority of candidates correctly identified that the point was an outlier. A written description of the building being significantly taller than the others was rarely seen. Part (d) distinguished the more able candidates as it required the ability to recall the formula for calculating outlier limits which is not given on the formulae sheet. It was disappointing to see some candidates recall a correct formula but fail to read the question and calculate the limits for Asia (using 90 as the IQR) instead of America. It was again unfortunate for some who lost the final mark after calculating the limits for the outliers correctly, but then failed to make an appropriate comparison with the 442. A fair number of blank responses were seen here.

In part (e) candidates are familiar with the shape of a box plot and many achieved two marks but missed out on the final mark for the plot being fully correct due extending the upper whisker too far and neglecting to plot the outlier. The comparisons required in part (f) should be standard by now. Succinct answers where candidates went through each of the key features of the box plots were particularly successful. Some candidates wrote lengthy discussions which included comments on the lowest value/lower quartile/upper quartile/highest value which were not required and did not score any marks. Generally candidates succeeded in using the correct statistical terms when comparing the median. The mark for both box plots being positively skewed was least often awarded, in part due to a lack of comment on

skewness, but also due to candidates mistakenly claiming that the box plots were negatively skewed. Candidates should understand that using 'wider' rather than 'greater' when comparing range or IQR is not an acceptable response.

Question 11

Whilst parts (a) and (b) were generally accessible to all candidates part (c) proved very challenging for most. The question will indicate when an interpretation is needed as part (b) only required a description of the correlation. Some candidates were able to demonstrate the ability, in (c)(i), to recognise a gradient as a rise divided by a run, but then did not go on to use relevant values. Of those candidates who attempted to find the gradient of the line, quite a few did not recognise it should be negative. It was also common to see an incorrect calculation of $\frac{\Delta x}{\Delta y}$ instead of $\frac{\Delta y}{\Delta x}$. In (c)(ii) answers generally looked more like interpretations of correlation (or strength of correlation) rather than gradient. Consequently it was very rare to see a correct interpretation of the gradient as the decrease in rainfall per unit increase of sunshine.

Question 12

It was pleasing to note that there were only a small number of candidates who did not attempt this question or who made attempts which indicated a lack of understanding. Where candidates only gained two marks in part (a) this was most often due to obtaining an incorrect value of $\sum d^2$ (usually following one slip) although some candidates lost the final mark as they had performed the calculation correctly but rounded to 0.1 without sight of the 0.095.

The majority of candidates were able to identify the type of correlation shown but interpretation of the correlation in the context of the judges' scores proved more difficult and a significantly lower number of candidates were able to achieve full marks in (b). The interpretation of no correlation is not something candidates find easy.

Question 13

This question was a good discriminator. If a candidate scored a mark here, it was most likely for identifying the mean of Test 1. Finding an acceptable value for the standard deviation was rare, with many candidates trying to use a formula rather than using the graph. The most successful candidates found the difference between the highest value and the median and divided this answer by 3.

In (b) candidates were generally better this year than previous years in calculating standardised scores with a higher proportion correctly evaluating at least one of the standardised scores. For the comparison part of the question the first mark was the most frequently awarded for the decision of performing better on Test 1. The justification for this decision was less successful. Some believe that scores closer to 1 or -1 are better. Those candidates who did not calculate standardised scores were still able to answer the comparison part of the question from using the diagram and correctly showing an understanding of the significance of being above the mean as better and below the mean as worse in this context.

Question 14

It was encouraging to see candidates show the calculation of the frequency density when drawing a histogram. This ensured they gained at least the method mark in part (a). Some struggled with the scale and lost the final accuracy mark for one incorrect bar height, whilst others still cannot distinguish between a bar chart and a histogram.

Generally poor expression hindered candidates' achievement in part (b). Though a large number of candidates wrote about why they thought the median was wrong, they did not sufficiently back up their reasoning with a clear statement identifying the location of the true median or supporting calculations. A large number of candidates failed to attempt this question.

Whilst there were a good number of candidates who showed correct working and obtained the correct answer in (c) many gave estimates of 17 or 20 by simply guessing.

Question 15

Candidates persevered with the final question of the paper and most were able to access a number of marks here with only the most able ones making a worthy effort at part (d). Virtually all candidates were able to draw the correct horizontal lines and label these lines correctly in (a). At this level it would be expected that candidates draw a ruled line although some very wobbly and roughly drawn attempts were seen. Part (b) proved far more difficult and a variety of answers were seen here, including 0%, 95%, 99%, etc.

Those who paid attention to the scale on the graph generally had success plotting the point in (c)(i). Many candidates were able to explain the need to stop the production line or to reset it. Comments such as "throw that chocolate bar away" or "add more weight to the chocolate bar" were not uncommon but did not express clearly the need to adjust the machine.

There were many responses in (d) which described what warning and action limits are, rather than how they are used. For example there were lots of discussions about things such as "2 standard deviations above and below the mean" or "they are used to help monitor the process". Poorly expressed answers generally prevented candidates from achieving all three marks in this part. Quite a few candidates obtained the mark for knowing another sample needed to be taken but many candidates did not clearly explain about the sample being **between** the warning and action limits, rather they said "outside warning limits" which of course could include the region outside the action limits too.

Grade Boundaries

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