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Principal Examiner Feedback

Summer 2015

Pearson Edexcel GCSE
In Statistics (2ST01)
Higher Paper 1H

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GCSE Statistics 2ST01
Principal Examiner Feedback – Higher Paper 1

Introduction

Candidates on the whole seemed to find the paper accessible and generally had time to attempt all questions. Candidates are continuing to improve in using the correct statistical language, which is expected when comparing distributions. Candidates must continue to be encouraged to show their working as some may have picked up more credit when their answers were incorrect. When interpreting or discussing results, 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.

A number of questions on this paper asked candidates to define or explain statistical terms. Overall, candidates should be working to improve their statistical vocabulary. Candidates should avoid repeating the term in the definition if possible i.e. using 'random' to describe 'random' sampling.

There are some topics in particular which were not well attempted including chain based index numbers, describing stratified sampling, interpreting correlation and calculating the gradient of a line of best fit.

There was some evidence of a lack of care in reading scales on graphs. For example in 6(c) many read off the incorrect value on the x-axis and in 11(b) candidates often were careless plotting the mean value correctly.

Report on individual questions

Question 1

This question was an accessible start to the paper with nearly all candidates identifying the correct countries in part (a). In part (b), a number of candidates did not read the scale properly whilst others simply wrote down the values read off the graph without subtraction. Part (c) proved to be more discerning. A common error was to find the area of land in Germany with forest as a percentage of land with no forest, i.e. 50%. Others gave 30% as a rough estimate and without working this could not score any marks.

Question 2

This question provided a good source of marks as two-thirds of candidates scored at least 9 marks here. Most candidates are very familiar with the drawing of a stem and leaf diagram. Common mistakes here were to omit a key or carelessly omit one of the leaves. Many candidates would have benefitted from checking their work here to ensure that all 16 scores were placed into the diagram. Most were able to use $\frac{(n+1)}{2}$ to find the correct median in part (b) though some followed through from an incorrect diagram in (a). Nearly all candidates worked out the range correctly.

When comparing distributions this should be done using a correct average and measure of spread, in this case the median and the range. Many were able to use an appropriate comparative term in part (d); however, a significant minority of candidates are still simply stating the two values rather than comparing them. Even those not scoring full marks in (d) were still able to choose the statistic required for the comparison here, the median, and correctly conclude Durham in part (e). A common mistake was to state that a smaller range leads to more points being scored due to the consistency.

Question 3

A surprising number of candidates at this level are unable to draw an accurate frequency polygon. Bar charts were commonly seen in part (a) and these scored no marks. Another common mistake was to plot the points at the upper bounds of each class. Still others believed it was necessary to join up the first point and the last point. Candidates should be using a ruler to join up the points with straight lines rather than attempting to do so free hand.

Part (b) was more successful with most candidates giving the correct modal class interval in (b)(i). Most attempted (b)(ii) and gave a correct explanation that Marc was correct relating to the median (40^{th}) peach. Some calculated the mean value instead of the median, and other common errors included assuming the median was the highest point on the graph or saying it was the middle of the 5 class intervals, i.e.140 – 150.

Question 4

Whilst many candidates gave examples of sampling frames in part (a), only few were able to come up with the appropriate statistical term. In part (b), most displayed an understanding of the term 'random' and answered with an acceptable definition about the equal likelihood of selection. A few candidates lost marks due to describing voters as having an 'even chance', or just a 'chance' of being selected. Some who struggled to define random often wrote about random number generators or taking something out of a hat or just repeated the word 'random' in their definition.

It was pleasing to see that candidates at this level understand the effect that sample size has on reliability and part (c) was generally well answered. Some candidates mistook what the question was asking as, instead of identifying sample size, they made comments relating to the number of people who voted for Mr Lopez or carried out extensive calculations which often lead to wrong conclusions. Choosers of the Morning Chronicle either thought a smaller sample was easier to deal with, or that the estimate was better since it was closer to 50%.

Question 5

This question was generally well answered with parts (c) and (e) discriminating the most able candidates. In part (a) most candidates scored the mark on this question with 'includes the whole population' and '(more) accurate' being the most popular answers. The incorrect response 'it gets more data' was given by a number of candidates.

Nearly all candidates knew what primary data was and it was rare to see answers that did not score here. Occasionally candidates were a little vague or unclear in their answers, e.g. 'data collected by someone'. Again, many candidates obtained the mark in (b)(ii) with reliability being the most popular answer. Some candidates restated the definition of primary data from (i) here e.g. 'you collect it yourself' without expanding this to give the explanation as to why this would be advantageous.

Part (c) was not well answered and many candidates appeared to put down any piece of statistical vocabulary or statistical diagram that they knew. There were also several who repeated information from the question such as the 'amount of money spent'. The most popular correct answers from the candidates were 'standard deviation' or 'range' with IQR rarely seen. The most common incorrect answers were: 'mean', 'box plots', 'Spearman's rank', 'percentage' and 'stratified'.

Part (d) was answered very well with a significant number of candidates scoring all three marks and nearly all candidates getting one or two marks. The most popular responses discussed ensuring that the questions were not leading questions and had non-overlapping answer boxes. It is evident that there is still some significant confusion between open and closed questions for many candidates. A large proportion of candidates still wrongly believe open questions are better because the answers are more detailed without thinking about how difficult these sorts of questions are to analyse.

Some candidates misunderstood that the demand in part (e) was asking about problems associated with analysing data and there were many responses discussing how much data she would have and how long it would take her to do or that she may have more of one gender than the other. Out of the correct responses, many discussed 'poorly designed questions' and 'non responses'. One mark was significantly more common than two marks but it was quite common for no marks to be awarded.

Question 6

Part (a) was done well by the vast majority of candidates, but some did think that 35.5 was an acceptable answer. In part (b) candidates should be encouraged to show their working as many who gave an incorrect answer may have picked up a method mark for $45 - k$ or $k - 8$ or for evidence of subtraction of two values read off the cumulative frequency graph. Part (c) was done less well as there were a significant number of candidates that did not use the scale properly when attempting to find the number of rollercoasters with a height greater than 86 metres. Of those that did work out 12, most were able to correctly turn this into a percentage.

Question 7

The majority of candidates demonstrated a good understanding of box plots with only a few blank diagrams seen. With the exception of the upper quartile, most plots were completed successfully. It was pleasing that a significant number of candidates were able to take the information from the question and work out the upper quartile correctly.

In part (b) candidates were reasonably proficient at describing the direction of skew for each box plot. However, some failed to use the correct terminology, with many of these stating that year 7 had 'even' or 'neutral' skew. A significant minority of candidates described the skew in terms of median's position in the box plot.

Candidates who were able to recognise that 2.10, as Q3, represented 75% in almost all cases went on to score both marks in part (c). Whereas most candidates either did not attempt a coherent answer or wrongly developed an answer based on the difference between Q3 and the lower whisker multiplied by the 76 year 7 students.

Question 8

Though general sampling principles are known, this question showed that candidates have difficulty clearly describing a given sampling method. It was clear from the responses to part (a) that many candidates did not know what quota sampling was. The three most common incorrect answers were 'convenient', 'random' or 'stratified'. Most candidates scored at least one mark in part (b) by stating that this method would be 'easy' or 'boys and girls are equally represented'. For the disadvantage 'takes a long time' or 'biased' were the two most common correct answers. Quite a few candidates said that an advantage was that it was 'quick' (sometimes followed by time-consuming as a disadvantage) or 'cheap' relying on stock answers.

In part (c) most candidates scored at least one mark, but it was extremely rare to see all three marks scored. Candidates need to explain all steps in the process much more carefully, particularly as this question was marked (*) as QWC. The idea of using a register was the most common for the first mark although many described numbering the students without any reference to a sampling frame. The most common mark gained was the second one for picking a random sample as many said 'using a random number generator'. The idea that a stratified sample should be representative of the population was missed by many. Out of the candidates who did achieve this mark, the vast majority described how to calculate the sample sizes for a stratified sample rather than just saying it should be representative of the population. Some candidates confused stratified sampling with systematic sampling.

Question 9

Spearman's rank is a topic which begins to discriminate the more able candidates and only about 10% of candidates scored full marks here. In part (a) a number of candidates were able to give a correct reason why Stefan had not calculated the value correctly but more often than not they incorrectly stated that 'it cannot be negative'. The expression in part (a) was often muddled as many said 'it can't be bigger than -1' or 'it can't go past 1'.

A number of candidates believed parts (b) and (c) were referring to the quality of the dives rather than the ranking of the judges. Though a number were able to pick up one mark in (b) for describing the correlation as positive, there were few attempts made at interpreting it. Those who persevered in (c) again were able to score one mark by stating they were 'both positive' but only the most able candidates were able to compare the relative strength of the correlation or give a correct contextualised interpretation.

Question 10

Chain base index numbers remains a challenging topic for many candidates and just over $\frac{1}{2}$ scored 0 marks here. Though many candidates found it difficult to interpret the index number in context, some were aware that below 100 represented a decrease. It was evident that they were not always certain what was decreasing. A few candidates showed where the figure of 92 came from rather than interpreting it.

In part (b) it was clear that many candidates did not understand how to calculate chain base index numbers and candidates tended to score either 0 marks or 3. There were some instances of candidates losing the final mark due to incorrect truncation of the second answer to 103 without showing the full answer anywhere in the working out. Quite a significant proportion divided 27 and 28 by 26 i.e. not using chain base index numbers but taking 2008 as the base year.

Question 11

Overall candidates found this to be a difficult scatter graph question with the majority scoring 2 or fewer marks here. Many candidates were unfamiliar with the term 'response variable'. In part (a) candidates often focused on the word variable and not the word response. Here, answers such as 'the variable that changes' did not score the mark. When plotting the mean and line of best fit in (b), many candidates did well but too many mistakes were made with the mean by not correctly reading the scale of the y-axis. The majority of candidates had no problems with drawing a line of best fit through this set of data, though some did not pass their line of best fit through the mean point.

Part (c) was one of the most discriminating parts of the entire paper. Of those pupils who managed to calculate the gradient, the majority were unable to interpret it to gain the final mark. Errors included calculating a gradient counting squares rather than using the scale, while others attempted $\Delta x/\Delta y$. Candidates were rarely able to relate the gradient to the context of the questions involving

rate, calories and time. Most incorrect answers stated positive correlation or stated calories used increased with time.

Question 12

This question on probability was accessible to all candidates but only the more able ones were successful in part (b). Part (a)(i) was answered well by most. In (a)(ii) some candidates gave the incorrect denominator as 503, the total number of males. Part (b)(i) was more successfully done than (b)(ii) where the majority of candidates double counted the 48 people who were both female and in the conservative party. In part (c) nearly $\frac{1}{2}$ of the candidates failed to understand that the question asked about the proportion of females and not the total number of females in the two parliaments. Of those who correctly stated 'Argentina has a greater proportion', most were able to support this statement with a sensible calculation.

Question 13

Many good attempts were made at this question and there were some very good explanations in part (c). Part (a) had the most success with many correctly reading the correct value off the time series graph at quarter 3, 2005. On some occasions the value of the trend lined was given instead. Results in part (b) were more varied, but many were able to work out the seasonal variation correctly at this point.

Having been provided with a clue from parts (a) and (b), a significant number of candidates were able to express the need to use seasonal variation to make the prediction in (c). Where seasonal variation was mentioned, they often proceeded to gain full marks using the mean seasonal variation and the trend line. Some candidates incorrectly discussed the use of moving averages to make predictions.

While most candidates attempted part (d), few could give a correct supporting reason as to why the prediction is not reliable. The most common reason given was that it was only an estimate. Use of the term extrapolation was rare, but some did say it was beyond the set of data provided. Some gave more practical reasons relating to the fact the trend may not continue. Quite of few of the responses gave arguments for and against reliability and candidates should be reminded that giving both answers will not score any marks.

The majority of candidates answered part (e) correctly as they identified that the figure was far below the trend line.

Question 14

This question was generally answered well although some candidates wrote down what Σx^2 meant instead of showing that it equalled 4888. Common incorrect working was to square all the values but not show them added; e.g. using commas or gaps instead of addition signs. Others added up all the values and then tried to square the total.

In (b) many candidates did not know how to work out the standard deviation but were able to write the formula from the formula sheet. These often scored 1 mark for calculating the mean amongst a lot of other working. A common error was to use 196^2 instead of 4888 in the formula. A few candidates lost marks for missing out the square root sign or giving a truncated answer of 3.2.

Question 15

Part (a) produced a varied response and was left blank on some occasions. Of those that drew a bell shape curve, most correctly centred it around 60. Those who appreciated how to incorporate +/- 3 standard deviations into the sketch were rare. In part (b) many candidates thought that two or three of the variables could be modelled by a normal distribution. Only the most able candidates were able to pick out time taken to be continuous and, hence, the only suitable variable.

Question 16

It was pleasing to see that most candidates persevered with the final question of the paper and some good attempts were seen here. In part (a), many candidates did not know how to attempt this and just drawing a probability tree diagram was the most popular incomplete method. A small proportion of pupils correctly used algebra to work out the required probability.

In (b), some candidates came up with $\frac{3}{16}$ as their answer neglecting the fact that there were two ways this could happen. Those working in decimals seemed to do better than those working in fractions as some had trouble with fractional arithmetic and clearly did not use their calculators to check their answers e.g. $\frac{3}{16} + \frac{3}{16} = \frac{6}{32}$ or $\frac{3}{16} \times 2 = \frac{6}{32}$ were sometimes seen.

The binomial distribution was known by quite a few candidates in part (c), but far fewer knew the properties required for it. 'Only two outcomes' was the most popular property known closely followed by 'probability remains constant' with 'fixed number of trials' hardly ever seen. Popular incorrect answers in (i) were: 'standard deviation', 'tree diagrams', 'probability', 'scatter graph' and 'bar chart'; and in (ii) it was common to see descriptions of growing conditions for the plants.

Many candidates attempted to use the binomial expansion for part (d) and a lot scored one mark for using one part. The most common answer scoring one mark was for candidates to use $4p^3q$ but to omit the p^4 term so consequently 0.42 was the most common incorrect answer. There were a few who used all of the terms or wrote out the entire formula but did nothing with it. Nearly $\frac{1}{4}$ of candidates did find the correct answer to this part.

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