LEVEL 3 CERTIFICATE
MATHEMATICAL STUDIES

1350/2A: Statistical techniques
Report on the Examination

1350
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General

There was a reasonable response to most question parts. In particular, students showed good understanding of statistical concepts and critical analysis.

Topics that were done well included:

- calculating averages
- criticising graphs
- solving a problem using a regression line
- calculating and using product moment correlation coefficients
- understanding the Normal distribution.

Topics which students found challenging included:

- calculating with proportionality
- identifying improvements to graphs
- understanding a sampling method
- knowing correlation and causation in context
- using inverse probability.

Students also found it difficult to give correct qualitative responses.

Question 1

Most students attempted all parts of this question. There were very few incorrect answers in part **(a)**, with most students able to deal confidently with averages. The most common error involved calculating to the wrong level of accuracy.

In part **(b)**, most students identified errors on the graphs, and some suggested appropriate improvements. It was not uncommon for students to write 'bottom axis' instead of 'x-axis'.

In part **(c)**, most students scored at least one mark by calculating the mass of fat in the 160g packet of crisps. Many students did not work out accurately that there are 23 lots of 10p in £2.30 and therefore made an incorrect conclusion. Some marks were lost by not comparing values to support their final answer.

Question 2

In part **(a)**, only a small percentage of students gained full marks. Some students just identified the errors on the main article and corresponding graphs, but did not make any recommendation to improve them. Most students were able to identify improvements on the graph, but found it difficult to offer improvements for the main article. Very few students recognised that the article could be improved by showing all data in tables.

In part **(b)**, most students were able to calculate the percentage increase correctly, but could not give a qualitative response on the errors in the given calculation. Some were able to identify the need to multiply by 100 to get the answer as a percentage. Some showed the correct calculation, where they replaced 509 with 493, but could not make a critical statement about their approach.

Part **(c)(i)** was well answered, and most students were able to identify the highest and lowest values in order to find the range. The main error was that students did not make a conclusion or incorrectly estimated the values from the graph for the given year.

In part **(c)(ii)**, many students did not correctly calculate percentage decline. The majority of students used values from the graph rather than those given in the main article. On a few occasions the final mark was lost for a wrong conclusion from correct working.

Question 3

In part **(a)(i)**, the correct use of statistical functions found on the scientific calculator was evident. Some marks were lost when students were able to calculate values for "a" and "b" but then failed to give an equation for the regression line, with many leaving it as an expression. Some students included the outlier in their calculation.

In part **(a)(ii)**, many students who gave an equation for their regression line in part (a) managed to score full marks by drawing a correct regression line. Where marks were lost, it was usually for plotting the calculated line inaccurately, either by eye or by using only the mean point instead of two calculated points.

In part **(b)**, the majority of students were able to use their regression line or equation to find the price for decorating an area of 84 m^2. However, several students did not add the preparation charge to their value. Some students who had not scored any mark in parts (a) and (b) were able to use their line of best fit to score full marks in this part (c).

Question 4

Most students scored the first mark in part **(a)** by correctly calculating the proportion of response times below 8 minutes, but could not justify the statistical validity in using a small sample size to score full marks. It is very common to see students calculating the sample mean instead of using proportion.

In part **(b)(i),** the majority of students found the correct mean and z-value and went on to use the formula to find the correct confidence interval. However, many students made one or more errors in the formula, with the values of standard deviation and variance often being mixed up, and some used the square root sign incorrectly.

In part **(b)(ii),** most students scored at least 1 mark for their judgement, though many did not appreciate that their interpretation was based on the value being within or outside of their confidence interval. Many students referred to the value being close to the sample mean calculated in part **(b)(i)**.

Question 5

Students could usually select the correct process to find the combined mean in part **(a).** The majority of those who scored zero calculated the sum of the point estimates and divided by 3.

Some students who took the first correct step then divided their sum by 3, leading to an incorrect final answer, or prematurely rounded their numbers before the final step.

Part **(b)** proved to be quite a challenging question, with a variety of incorrect approaches used. Only a few students scored full marks, as most could not compute the required 3-digit random numbers using modulo 225. Some marks were lost for not giving answers in 3-digit form, with, for example, 050 often written as 50.

Part **(c)** was generally well attempted, with most students able to find the product moment correlation coefficients using their scientific calculator. The main error for unsuccessful students was to attempt to find the product moment correlation coefficient using the formula. However, even with incorrect values of product moment correlation coefficient, some students were able to choose the correct estimate by comparing both values. It was common to see students calculating the product moment correlation coefficient for diameter/height and then going on to compare height/age with diameter/age.

Question 6

Only the most successful students scored well in this question.

In part **(a)**, many students managed to identify the two variables that were strongly correlated but could not identify which variable caused the other to change.
Height/age was a common wrong answer and temperature/ice cream sales was a common correct answer.

In part **(b)**, a significant majority of students were unable to identify two variables with strong correlation that do not cause a change in each other. Students found it difficult to distinguish between correlation and causation and hence to identify that it is a third, external factor that could cause a change in the two variables.

Question 7

Students generally scored more highly on this question involving Normal distribution than in previous exam series. There were relatively few incorrect answers in part **(a)**, with most students able to deal confidently with basic features of a Normal distribution model.

In parts (**b)(i), (b)(ii)** and **(b)(iii)** it was evident that students were able to use their scientific calculators effectively to find the correct answer without having to write down any working, which gained full marks. It was also good to see students drawing the bell-shaped diagram to represent their calculated values.

In part **(c)**, students found the reverse usage of the Normal distribution to be difficult. Some lost the final accuracy mark for not giving their answer to the nearest £1000. Not many achieved full marks for this part as they used 0.1 as their z-value, but they managed to gain some marks for setting up an equation and solving it correctly.

Use of statistics

Statistics used in this report may be taken from incomplete processing data. However, this data still gives a true account on how students have performed for each question.

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the Results Statistics page of the AQA Website.