Examiners' Report
Principal Examiner Feedback

Summer 2023

Pearson Edexcel GCE

In AS Level Mathematics (8MA0)

Paper 21 Statistics

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Introduction

Questions 1(a), 2(a)(b), and 4(a) proved to be accessible to nearly all students taking this examination and questions 3 and 5(a) offered some discrimination for the more able. Most students made their method clear and this is particularly important when selecting the correct probability distribution or completing a hypothesis test.

Question 1

Part (a) was a generally successful start to the paper with the vast majority of students able to show sufficient calculations to arrive at the given mean. A few students opted to use the upper class boundary in their calculation. On some occasions $\frac{3186}{50}$ was written with no supporting evidence. Some students misunderstood the demand and attempted to use interpolation to find the median instead of the mean.

On the whole part (b) was also well attempted. A common error remains that students confuse $\sum fx^2$ with $(\sum fx)^2$.

Many students were able to score the mark in part (c) as they gave an acceptable explanation why the standard deviation does not change. Some said it did not change but provided no supporting explanation whilst others believed the change in the mean would affect the standard deviation.

Question 2

This question was the second most accessible question on the paper thanks to part (a) and (b), but due to parts (c) and (d) requiring familiarity with the large data set, only a small minority of students scored full marks here.

Most students successfully answered part (a) with a correct interpretation of a lack of correlation shown in Figure 1.

Part (b) was also answered well with students answering in the context of temperature and pressure. There were some students who did not earn the mark as they only wrote negative correlation and others that described a negative correlation as one quantity decreasing as the other decreased.

It was notable that many students are still unfamiliar with the large data set and the general standard in parts (c) and (d) was poor. Most students guessed an answer to part (c) but very few were able to give an answer in the correct range. In part (d), the students often described the location of Beijing as a factor or repeated an answer given in previous examination series rather than comment on the Beaufort Conversion being qualitative data. It was clear the students who had studied the large data set as their answers had a concise explanation.

Question 3

This was the second most demanding question on the paper.

In this question there was some confusion between the number of students who study Art and the number of students who study Art but not Music. This often led to incorrect Venn diagrams and subsequent errors in both parts of the question.

In part (a), students often found that at most 20 students studied Music but not Art, but then went no further. Very few were able to find both required end-points.

The rule for independence is given to students on the formulae booklet, but many quoted it in terms of A and B rather than the events A and M as required in part (b) of this question. Students making little progress often tended to use numbers rather than probabilities throughout. Only a small minority arrived at the correct result of $x = 21.6$, but some then concluded that A and M were independent as 21.6 was in the range, ignoring the fact that x had to be an integer in this context.

Question 4

There were some good attempts seen at this question with most students able to display some knowledge of hypothesis testing.

Part (a) was very well answered with most students scoring this mark for a correct alternative hypothesis using the correct notation. A few students did not appreciate that this was a two-tailed test and gave a one-tailed alternative hypothesis.

In part (b), when attempted, most students acknowledged that it was a Binomial distribution and many were able to find the probability associated with at least one of the tails (usually the lower one). However, some did not take notice in the question that the probability in each tail was required to be as close to 2.5% as possible, and hence found an incorrect upper critical region. Marks were sometimes lost for failing to state the probability associated with each tail (particularly the upper tail) and for incorrectly identifying the upper critical region, usually opting for $X \geq 20$. There are a significant number of students writing the critical region as a probability. Many students with an incorrect critical region were still able to earn the mark in part (c) using the correct probabilities for their tails.

Part (d) was answered well by many students, but, as usual, some did not interpret the conclusion in context. Some ignored the hypothesis test and critical regions altogether and simply compared 10 as a percentage of 50 with 25% to suggest a change in probability.

Question 5

The final question on the paper, as expected, proved to be the most demanding as many students were unable to make any progress at all here.

Part (a) was the most discriminating with many students leaving this part blank.
Students often thought that X followed a binomial distribution. Some tried to work out individual probabilities for each letter rather than focusing on the number of A's that could be selected. A large number of tree diagrams were seen but some could not get from the diagram to a probability distribution as they were unable to give a probability for each of the different

values of X. Students who correctly worked out the probability of obtaining 1 or 2 A's sometimes did not recognise that the answer needed multiplying by 3.

Part (b) saw a higher standard. Students were able to work out that a binomial distribution needed to be used and many were able to give the correct value of n and p. One common mistake involved choosing 9 trials rather than 10 as there are 9 letters in DEVIATION.

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