Examiners' Report
Principal Examiner Feedback

Summer 2024

Pearson Edexcel GCE

In AS Level Mathematics (8MA0)

Paper 21 Statistics

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Introduction

Questions 1, 3(a)(b), and 5(a) proved to be accessible to nearly all students taking this examination and questions 2 and 5(c)(d) offered challenge 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

This question proved to be a successful start to the paper for most students, with many scoring full marks. Those who struggled did not recognise that 25% of the players' heights represented the lower quartile. They were still able to draw the interquartile range to the correct distance. Most students were able to correctly draw the whiskers for the lower and upper values, but there were a small minority who have no idea what a box and whisker diagram should look like, and some just plotted points or simply vertical drew lines.

Question 2

This question was generally not well attempted demonstrating that students are still not completely familiar with the large data set. In part (a) many students appeared to be aware of Camborne's location in the South-West of the UK but could not relate this to the prevailing winds in that area. Some students were able to guess that A represented East but were unable to provide a reason. Many students did not appreciate that wind direction is the direction that wind blows from, rather than to.

In part (b), many students appreciated that the value was an outlier and should be excluded but were unable to score the marks here without justification. Those who understood that the maximum that the angle could be 360, tended to score well here. Some students also thought that 999 represented a frequency rather than an angle.

Question 3

Part (a) was well attempted and almost all students realised that the two missing frequencies should sum to 32.

In part (b), the most usual mistake was to use frequency rather than frequency density for the heights of the 4 – 6 and 6 – 8 bars, drawing them at 7 small squares and 3 small squares respectively. Also, the first bar was often seen drawn from 0 – 2 instead of 1 – 2 often with an incorrect height.

Part (c) was not well done and quite often no attempt was made. Some students substituted one or more values of x, setting the result equal to the frequency (or frequency density). When integration was used, it was often done well. It was, however, surprising to see that even when the correct integration was equated to 112, many were unable to accurately solve the equation. Many students made slips with the negative signs, and some were unable to solve the equation, multiplying one side by 8 to get rid of the fraction but failing to multiply 112 by 8 at the same time.

Question 4

This question was generally well attempted, but there are still a significant number of students who show no understanding of hypothesis testing. Some students truncated the values seen on their calculators rather than giving them to an appropriate degree of accuracy.

Part (a) was well answered with the majority of students gaining this mark, the only issues occurring with rounding or calculating $\mathrm{P}(X \leq 10)$ rather than $\mathrm{P}(X = 10)$.
Part (a)(ii) was less well attempted with many students unsure of the difference between ≤ and <. The most common error seen was to evaluate $\mathrm{P}(X \leq 14) - \mathrm{P}(X \geq 12)$ although many other incorrect expressions were seen. Often when students worked out $\mathrm{P}(X = 12) + \mathrm{P}(X = 13) + \mathrm{P}(X = 14)$, they attained full marks.

For those who attempted part (b), this was answered much better than in previous series and students are becoming more familiar with the structure of these questions, writing the hypotheses in terms of p and the distribution clearly. Sometimes the probability statements were not clearly stated, with students writing down the values that they had inputted into their calculators. It was quite common to see $\mathrm{P}(X < 3)$ or $\mathrm{P}(X = 3)$ rather than $\mathrm{P}(X \leq 3)$ calculated. The conclusion was not always given in context. When the context was given, it was usually correct, although missing out the word "proportion" or its equivalent meant the mark was lost.

Some students chose to use a critical region approach rather than a p-value approach, but they often did not make this clear and some were then unsure about whether 3 was inside or outside the critical region and what this implied for the acceptance or otherwise of H_0

Part (d) was frequently omitted or the value $p = 0.12$ given. Those who used the critical region approach rarely got this mark. However, students are becoming more aware of what the p-value represents.

Question 5

The final question on the paper, as expected, proved to be the most demanding and parts (c) and (d) were only completed by the most able students.

Part (a) and part (b) was generally done well by the vast majority of students. A large number of students overcomplicated their workings by calculating probabilities for all 9 possibilities rather than simply calculating $\mathrm{P}(not\ 7) \times \mathrm{P}(not\ 7) \times \mathrm{P}(7)$.

Many students still do not understand the concept of a probability distribution and many attempts were made to calculate a single probability, usually from a binomial distribution, in part (c). Some students were able to make a good attempt at the probability distribution, but a large number failed to correctly calculate $\mathrm{P}(S = 4)$ as they didn't account for the spinner failing to land on a 7 four times.

Most students left out part (d) as they were unable to interpret what this probability represented. Of those who did try, many complicated probability expressions were seen often leading to an incorrect answer.

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