Examiners' Report
Principal Examiner Feedback

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Introduction

There were opportunities for students to make a start in most questions except for question 2 where some students couldn't see how to get started. The final parts of questions 1, 4 and especially 5 were quite challenging. Question 5(c) proved too difficult for this cohort but otherwise there were some good attempts at the rest of the paper.

Report on Individual Questions

Question 1

Part (a) was answered well with most students differentiating the 2nd row of F(x) correctly and many managing the 3rd row too though some lost a minus sign.

The sketch in part (b) was often correct but some did not have a triangle with a base on the x-axis and some failed to give some indication of scale: we expected to see the points $x = -1$, $x = 4$ and the vertex at (0, 0.4). Those who had a correct sketch were usually able to describe the skewness correctly as "positive".

Part (c) proved to be more discriminating. The most popular approach was to try and form an equation for c using $F(c) - F(1) = F(2) - F(c)$. Unfortunately, a number of students didn't realise that the 3rd row of the cumulative distribution function was required, and some had a mixture or simply used the 2nd row. Even those who were using the incorrect parts of F(x) were able to form a quadratic equation in (c) and solve it with many realising that one root had to be rejected because the value was outside the domain of the function.

Question 2

Usually, the calculation of Spearman's rank correlation coefficient is a good source of marks for all students. It was unfortunate here that some could not see how to get started and there were attempts to write down coordinates for each of the 8 points and this made the question unnecessarily difficult. Those who didn't even try this could often obtain a mark for writing the hypotheses in terms of ρ or ρ_s and usually the correct critical value was written down from the tables. Those who did realise that they could simply order the ranks often did so correctly and were able to find the correct value for r_s and usually make a correct conclusion for the test. A few students used their coordinates to find the product moment correlation coefficient which used up precious time and usually scored no marks.

Question 3

In part (a) many students were able to differentiate and show that $y = 1$ gave a turning point but few gave a convincing argument to explain why this meant that the mode of Y was 1. It was disappointing that so few drew a sketch of f(y) as it was simply part of a simple quadratic, and not only would this have shown that the mode was at 1 (by symmetry) but it would also have provided a quick route to answering part (b).

In part (b) a variety of different approaches were seen. Some decided to find F(y) and evaluated F (2) and were able to argue that since F(2) > 0.5 and for the median m F(m) = 0.5 then m must be < 2. Others simply used their calculators to find P(Y < 2) and used a similar argument. Some found the cubic equation F(m) = 0.5 and then solved this using their calculators and were able to state that m = 1.37 and is therefore < 2. The subtle approach of using the symmetry around $y = 1$ was, sadly, not seen. In part (c) most heeded the instruction to use algebraic integration to find E(Y) and could then find Var(Y) and multiply this by 4 to obtain the answer.

Question 4

Almost all students gave the correct value for E(X) in part (a) but many didn't spot that in part (b) P $(1 < X < 4) = \mathrm{P}(2 < X < 4)$ and there were a number of incorrect answers of 0.6

In part (c) most were able to find the correct critical values of 3 and 4.5 and many realised that the "outside" region was required. There were several errors in finding the two probabilities and a couple of students had the correct values of 0.2 and 0.5 but then multiplied them together rather than adding them.

Part (d) was more challenging, and many did not appreciate that this was a case of finding E(g(X)). There were the inevitable attempts to find $\frac{3}{\mathrm{E}\left(X^2\right)}$ and some interesting attempts at finding $\mathrm{E}\left(X^2\right)$ based on $\frac{\left(2^2+7^2\right)}{2}$ which was presumably a variation of the formula for E(X). There were a good number of correct solutions though that safely arrived at the correct answer.

Question 5

In part (a) most knew that they needed to find S_{ss} and usually they realised this could be found using the gradient of the regression line. The correct value for *r* normally followed.

Part (b) was answered very well with the vast majority finding $a = 0.1177$ and then the predicted arm span of 1.76 metres.

Part (c) was not answered well. Those who attempted it usually found that Ewan's height was greater than the regression line would have predicted, and they argued that this would mean that the line would be steeper. A correct deduction based on the formulae for S_{ss} and S_{sh} was not seen. The key point is that since the arm span of Ewan is the same as the mean of the original 24 then the mean of all 25 *x* values will be the same. This means that both S_{ss} and S_{sh} will not change when Ewan is added and so the gradient will not change either. Formal justifications of these observations were not expected though, of course, they can be proved algebraically using $S_{ss} = \sum (s - \bar{s})^2$ and noting that the 25th term of the series is of course zero. A similar argument can be made for $S_{sh} = \sum (s - \bar{s})(h - \bar{h}) = \sum (s - \bar{s})h$ and noting again that the 25th term of the series is zero.

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