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Examiners' Report
Principal Examiner Feedback

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Further Mathematics (8FM0)
Paper 24 Further Statistics 2

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Introduction

The vast majority of candidates found this paper accessible and were able to complete it within the required time. Candidates need to ensure that they have a good knowledge of specialist statistical vocabulary when sitting this paper, for example understanding the difference between a critical region and a critical value. Better understanding was shown with regards to residuals and it was pleasing to see conclusions to hypothesis tests stated with sufficient context.

Question 1

The majority of candidates made a good start to the paper in part (a) by being able to use the given formulae to obtain the Spearman's rank correlation coefficient to an appropriate degree of accuracy.

Part (b)(i) was less successful with the majority of candidates stating a critical value rather than a critical region. A few candidates incorrectly used the PMCC table to find their critical value. In (b)(ii) candidates on the whole gave sufficient context in their conclusion stating there was not enough evidence to reject the null hypothesis, and hence not enough evidence of agreement in the film ranks.

Part (c) was again well attempted with many demonstrating understanding of how the additional piece of data would affect the Spearman's rank correlation coefficient. On a few occasions, candidates incorrectly believed that since the value of $\sum d^2$ would be unchanged, so would the value of the correlation coefficient, not realising the fact that n was not equal to 11 instead of 10. A correct critical value found in most cases as was a correct contextualised conclusion.

Question 2

There was a mixed response to question 2 with many candidates not knowing where to begin. In part (a), some candidates recognised that area represents frequency – but a common slip was to see $\frac{4\times 0.1}{2}$.

Part (b) was significantly less successful and although partial attempts were seen, only the most able candidates provided complete solutions. It was common to score the second method mark for understanding that the area from $7 \le x \le 11$ involved $0.1x$. Many neglected to include the area from $1 \le x \le 7$. Those using a + c method tended to be successful particularly when applying F(11) = 1. A common mistake was to believe that F(7) = 0.

Question 3

Part (a) of question three proved to be the most accessible part of the paper with the majority of candidates gaining full marks.
In part (b), the vast majority of candidates stated that since r was close to 1, the data was consistent with a linear model. A few just stated there was positive correlation, but this was not sufficient.

Nearly all candidates were able to gain some marks in part (c) with finding the equation of a regression line being a well-versed technique for many. Premature rounding caused issues for some, losing the final accuracy mark. On a few rare occasions, y was used instead of w in the regression equation.

In part (d), most realised that they needed to substitute $x = 32$ into their regression equation, but fewer realised the needed to add 80 to find the weight of the bream.

Answers to part (e) varied. Many correctly identified that the residuals were not 'randomly scattered' above and below 0 after $x = 33$ and that this meant the model may not be linear in this range. A common incorrect response was to assume that there was now 'negative correlation' since the residuals were decreasing as x increased.

Question 4

Question 4 was a challenging question which discriminated the most able candidates, particularly in parts (a) and (b). In part (a), there were many attempts at integration and most equated their integral to 0.5 earning at least the first method mark. A surprising number of candidates did not know how to proceed with some plugging in both limits $x = 2$ and $x = 4$. Even those who chose correct limits often struggled to get to the final given answer not realising the need to multiply each term by m^2.

In (b)(i) candidates demonstrated good knowledge of differentiation virtually always finding the correct answer. In (b)(ii), many attempted to set this equal to 0 rather than realising that it was not possible for this expression to be equal to 0. Some stated, without justification, that $x = 4$ was the highest point on $f(x)$. The most able candidates understood that the derivative showed that $f(x)$ was an increasing function. Some opted to sketch $f(x)$ which was also sufficient to justify that the mode here was $x = 4$.

Part (c) was successfully attempted with most showing all stages of working and remembering to square the mean before subtracting. Correct answers were seen often.

Question 5

The final question also gave opportunity for the most able candidates to shine as part (c) of this question was the most difficult part of the paper. Although some attempts were made, correct solutions were rarely seen.

Most completed part (a) successfully.

In part (b), many did not understand that a single probability region was required. Of those actually identifying the critical values of T for the required probabilities, often, a product of $\mathrm{P}(T < 2.25) \times \mathrm{P}(T > 2/3)$ was attempted.

Finally in part (c), although candidates were able to state $\mathrm{E}(R) = 1.5$, the attempts at finding $\mathrm{E}(G)$ were generally poor. A common misconception was that $\mathrm{E}\left(\frac{2}{R^2}\right) = \dfrac{2}{\mathrm{E}(R^2)}$. Some responses concentrated on a single game's score, rather than the expected total of the game in the long run. Although it was true that Raja was likely to score higher on a single game, the expected total shows that Greta is the expected winner of the game.

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