Examiners' Report
Principal Examiner Feedback

November 2021

Pearson Edexcel GCE
In Further Mathematics
Paper 3B Further Statistics 1

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Introduction

The paper was accessible to the majority of candidates and most appeared to have sufficient time to complete it.
Questions 1(b), 2(d), 4(c) and 7 were the most demanding parts of the paper. In general, questions that require justification and statistical reasoning were less well answered.

Report on Individual Questions

Question 1

Part (a) was a straightforward opener and most candidates answered this correctly.

In part (b) many recognised that there was one constraint but described why there is not a second constraint and made no reference as to why there is one restraint.

In the final part most calculated the test statistic accurately and the critical value. Of those candidates who didn't gain the correct statistic the majority did not show any working. This was a risky strategy as an error using the calculator results in the loss of marks. Students need to check their calculator entries carefully but would be advised to show at least some evidence of how they calculated the test statistic.

Question 2

This was a well answered question although few candidates gained full marks.
In part (a) as it is a "show that" question the method needs to be clear and in order to show that the answer given is 0.8883 to 4 decimal places the value calculated should be given to at least 5 decimal places.

Part (b) was well answered with the majority of candidates gaining full marks.

Part (c) was a good discriminator. The most common errors were

- not realising they needed to work out the probability of exactly 8 calls
- using the binomial distribution rather than the Poisson approximation which had been requested in the question.

In part (d) many students quoted the standard answer, *n* large, *p* small, and did not refer to this particular case. They either needed to refer to the figures or the context given in the question.

It was pleasing to see that in part (e) most candidates used the correct parameters.

In part (f) most candidates realised they needed to use Po(30). Many candidates were then able to go on and gain full marks. There are still a number of candidates who calculate $P(X = 40)$ rather than. It was pleasing that most candidates give their final conclusion in context.

Question 3

Many of the candidates who realised that the central limit theorem was needed gained at least the first 2 marks. The most common error was using $\frac{0.9216}{400}$ for the variance rather than $\frac{0.9216}{100}$. Use of correct notation was not good with the statements like $X \sim \mathrm{N}\left(256, 0.9216\right)$ often being <u>used</u> correctly as $\overline{X} \sim \mathrm{N}\left(256, 0.9216\right)$. Candidates should be aware that there is an assessment objective in the new specification that requires "correct use of mathematical notation" and correct handling of normal distribution notation may be required in future assessments.

Question 4

The approach candidates used to this question varied. Most candidates were able to use the conditional probability to form an equation in terms of b and c. The method used by candidates then differed. Those who realised $\mathrm{E}(N) = 3.2$ were generally the most successful as this results in an equation in terms of b and c only and then solved the 2 simultaneous equations.
Those who chose to calculate $\mathrm{E}(4N + 2)$ ended up with an equation in terms of a, b and c. to form a third equation they needed to use the sum of the probabilities equates to 1. Many of the candidates who used this method were unable to then solve 3 simultaneous equations.

In part (b) the most common error was a failure to include a fee of zero. Those who had some form of probability demonstrated that they knew how to calculate the expected fee to gain the second method mark.

Part (c) was very poorly answered. A few students said that a Poisson distribution assigns some probability to values greater than 5 but this sort of situation will always be the case when a Poisson model is used to model a finite discrete distribution. The key feature in this case is that a substantial probability is assigned to values greater than 5 which means that the model is poor.

Question 5

In part (a) the main error was to calculate the probability that exactly 3 counters are drawn before a red is drawn.

Part (b) was usually well answered but a few candidates forgot the $\binom{8}{1}$

Part (c) was well answered with most candidates being able to set up the two equations (although some used 660 rather than 660^2) Most candidates knew how to solve the equations to find a value for p

In part (d) it was pleasing to see that the hypotheses were generally correct with most using the appropriate parameter along with the distribution being clearly stated. Those candidates who chose to form and solve an inequality were generally successful. However, those who chose to compare probability statements often selected the incorrect region $J \geqslant 32$.

Part (e) most candidates compared their CR with 34 correctly although many did not have the correct conclusion with the required context.

Those candidates who got the wrong critical region in part (d) were able to gain the method marks in part (f) if they showed their working clearly. When the answer is given in the question it is always wise for candidates to check that their calculation gives the required answer rather than just assume it does. As it is a "show that" question the method needs to be clear and in order to show that the answer given is 0.702 to 3 significant figures the answer should be given to at least 4 significant figures.

Question 6

This question was answered well by candidates who were well prepared on this topic.

In part (a) most candidates managed to clearly show that $G_X(1) = 1$ was required although it was not always clearly stated on its own.

In part (b) whilst candidates realised they needed to find the coefficient of t^2 time (which could have been used elsewhere) was spent on calculating all the terms of the expansion rather than just the one needed.

The majority of candidates who attempted parts (c) and (d) knew what was required and gained full marks.

It was clear in part (e) that most candidates knew how to use the probability generating function to find the variance but there were a few who struggled to differentiate the given function correctly. Those who did differentiate correctly and simplified their answer invariably were able to complete this part of the question.

Question 7

Candidates who answered part (a) knew what was required and gained the mark.

Part (b) was the most demanding question on the paper and very few candidates were able to form either equation needed to be able to find the value of *n*.

The most common error was to $\dfrac{15-14.9}{\frac{0.2}{\sqrt{n}}} = z \text{ value}$. Some also used $0.2\sqrt{n}$ rather than

$\dfrac{0.2}{\sqrt{n}}$

Even if the candidate was not able to do part (b) they were able to attempt part(c). It was pleasing to see that many did attempt it but very few knew that it would decrease.

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