Examiners' Report
Principal Examiner Feedback

Summer 2025

Pearson Edexcel International Advanced Level
In Statistics S3 (WST03) Paper 01

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General

Overall, this paper allowed all candidates to demonstrate their ability and knowledge of the WST03 specification. It was pleasing to see many strong performances across all questions, and the presentation of solutions was very impressive at times. Question 6 and the 8(c) provided the most challenge, although there were still a pleasing number of fully correct solutions. Time did not appear to be an issue.

Report on individual questions

Question 1

This question tested understanding of systematic sampling in a given context. It was only worth three marks, but it was not particularly common for full marks to be scored.

Part (a) was generally poorly answered. The mark scheme comment of 'it reduces the potential of bias' is exactly what this would do. Variations on this were acceptable if the candidate clearly understood that the aim was to produce an unbiased sample. Otherwise, they had to amplify on the meaning of random.

In part (b), occasionally there was some confusion between the position of the first one selected and the interval between the members selected from the list, but typically candidates wrote down the correct answer.

In part (c), most candidates were able to correctly write 0 here or e.g. 0%

Question 2

This question was answered very well by the majority of candidates. Testing for correlation and calculating Spearman's rank correlation coefficient between two variables is a topic that candidates feel confident with the underlying theory and it was pleasing to see many solutions presented with accuracy and precision.

In part (a) most candidates showed their working to find $\sum d^2$ and then went on to apply the formula correctly to achieve $r_s = 0.6$. A small number of candidates forgot to take this away

from 1 so ended up with $r_s = 0.4$. Those candidates using the calculator without showing any working should be aware they risk losing all three marks for a slip when typing into the calculator.

Part (b) was also answered well. A small number of candidates lost the first mark for writing the hypotheses in words rather than in terms of ρ. Nearly all candidates were able to correctly state the critical value and compare to their r_s but there were a small number using the normal distribution to incorrectly find the critical value meaning they were unable to score the method or accuracy marks that followed. Most candidates gave a correct contextual conclusion although a few failed to mention either positive correlations, ranks or judges.

Question 3

This question was generally very accessible to candidates on contingency tables with many scoring full marks.

Part (a) was very well done with only a few considering the wrong cell.

In part (b), few candidates incorrectly wrote their hypotheses the wrong way round or did not give enough context in their hypotheses. Occasionally candidates forgot or did not know how to evaluate the contribution from the cell to X^2 and so incorrectly added 5.04 to 7.44. The degrees of freedom were usually calculated correctly but 3-1 and 9-1 were sometimes seen.

Question 4

This question tested unbiased estimators of the mean and variance followed by a hypothesis test on the difference between two means.

Part (a) was generally answered very well, although a small number of candidates were unable to correctly apply the method for finding the variance.

Part (b) was more challenging, and some candidates were unable to state correct hypotheses in terms of μ. Common errors included using $\bar{x}$ and $\bar{y}$ or using subscripts other than x and y or g and r without defining them. Most candidates then tried to find $z = 2.46$ and compared it to the critical value. A less common method was to find the p-value and compare it to the significance

level. Errors finding the *z*-value were fairly common, particularly using $200-(500-290)$ as the numerator. Some candidates lost marks as they failing to give the critical value to at least 4 decimal places, often stating $z=1.645$ instead of 1.6449 or better. Most candidates then went on to reject H_0 and give a correct contextual conclusion – it was clear to see lots of candidates were using the exact wording from the question to avoid any errors. Errors were usually from stating the null hypothesis as the conclusion 'mean weight of grey squirrels is 200g more than mean weight of red squirrels' missing the 'greater than'.

The responses to part (c) were mixed, but most candidates were able to state $\sigma^2 = s^2$. They were not required to comment on needing this for both samples, on this occasion. Common answers that did not score the mark included vague comments about the CLT being applied, the samples being independent or that both samples were approximately normal.

Question 5

This quesiton tested the goodness of fit of a binomial distribution to a particular scenario.

In part (a), most candidates gave a correct solution here. Occasionally some candidates incorrectly calculated the average number of male puppies per litter and did not seem to question that this was a value greater than 1.

In part (b), again, this was well answered by either using the proportion calculated in part (a) or by using $250-\sum E_i$

In part (c), the most common error here was to calculate the degrees of freedom incorrectly, generally by using 6-1 instead of 6-2; some candidates had forgotten that '*p*' was estimated from the data themselves. If this was incorrectly calculated, then it may also have resulted in the the loss of the final A mark as they could reach the wrong conclusion.

Question 6

This question tested understanding of estimators of the mean and variance which is usually a topic that candidates find challenging. This was the most challenging question on the paper overall with many candidates dropping a mark in one of more of the individual parts.

In part (a), the most common correct answer given was no unknown parameters. Where candidates did not score a mark, it was usually because the statement was too vague.

In part (b), most candidates were able to proceed to $\frac{5}{4}\mu$ but many lost the A mark for either failing to include a conclusion or for not using expectation notation.

Candidates were usually able to find the bias of the estimator in part (c), although on occasion candidates would omit μ.

Part (d) was more challenging with some candidates not sure how to deal with μ even though it could be cancelled out throughout resulted in equations in just a and b. Nevertheless, many candidates were unable to form two correct simultaneous equations, although common errors included $a + b = 2$ and $14a + 5b = 20$. When the correct equations were found, then candidates usually successfully solved them simultaneously and scored full marks.

Question 7

This question on the central limit theorem was very accessible for the candidate who knew to standardise with the standard error. Incorrectly not using $\frac{\sigma}{\sqrt{n}}$ or μ was heavily penalised, however.

In part (a), the z-values were almost always correctly given. There are still many candidates, however, who do not appreciate the demands of a 'show that' question and not enough working was shown. Other candidates did not follow the instruction to use the tables and used their calculators which resulted in them losing the final mark. It was noted that not all candidates found the most efficient way to solve their equations. It may have been more beneficial to some candidates to consider the their strategy to solve which may well have yielded more marks here.

Part (b) was answered well in general; correct solutions were commonly seen here. If they had not used $\frac{\sigma}{\sqrt{n}}$ in (a) then marks could not be gained here as this was following from an incorrect method.

For many candidates part (c) was clearly the most straightforward part of the question. Even candidates who gained no credit in (a) and (b) frequently managed full marks here. Even if their mean was wrong in (b) they could gain the method mark.

Question 8

This question on combinations of normally distributed random variables proved to be a good discriminator amongst the most able candidates. As expected, candidates found this question challenging in particular in part (c).

In part (a), candidates usually answered this correctly with many recognising the need to use $\mathrm{N}(3\times18,\ 3\times0.3^2)$ and then correctly standardising, before proceeding to find the probability. When the variance was incorrect, in many cases it was usually 3×0.3, but they could still go on to score the method mark for standardising.

Many candidates were able to score the first three marks in part (b), but it was common for them to miss the need to multiple their 0.319×2. Some candidates did not standardise, despite the instruction to do so and so they lost marks in such cases.

Only the most able candidates were able to score full marks in (c) with 101010 being a common mark profile. The most common error came from finding $T \sim \mathrm{N}(644,\ 0.0697)$ and then going on to find $\sigma^2 = 0.0697 + 0.2^2 \times 30^2 = 36.069$ ... instead of $\sigma^2 = 0.0697 + 0.2^2 \times 29^2 = 33.66$ ... A smaller number of candidates used $\mathrm{N}(4,...)$ but again the variance was usually found incorrectly.

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