Examiners' Report
Principal Examiner Feedback

Summer 2022

Pearson Edexcel International Advanced Level
In Statistics S2 (WST02) Paper 01

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Question 1

(a) A nice start to the questions with the majority of students giving the correct answer.

(b) The most common error was to find the mean of X (2.4) rather than the mode. Those students who knew how to find the mode almost always showed relevant working as they calculated the probabilities.

(c) Although most students knew how to find P($W_1 = 2$) and P($X_1 = 2$) they were not always sure how to proceed. Instead of correctly multiplying they sometimes did nothing or added them together.

(d) This was one the most challenging parts of the paper not just this question. Some made no attempt. Others tried to form an inequality using the binomial and Poisson formulas, or attempted to find a model for $X_1 - W_1$. Those who understood that they needed to list the different possibilities normally gained at least some credit. When cases were listed, sometimes they were not all mutually exclusive or $W_1 > 4$ was not always taken into account.

Question 2

This question was usually either answered very well or no answer was given at all.

(a) Most students realised that $\int_0^4 tf(t)\,dt$ was required for this part and often did everything correctly but then left their answer as $\frac{16}{15}$or 1.07 and did not convert to minutes and seconds (or in the latter case with 1.07 gave it as 1 minute 4.2 s) and lost the final mark. One of the more common errors was to use $\int_0^4 f(t)\,dt$which gained the convenient answer of 1 minute.

(b) The majority of students answered this well showing clear substitution of the limits and, even the ones who used the wrong integral in (a) often used this with the limits 1 and 3. In a few cases students wrote F(3) - F(1) without showing the substitution. Student are advised that for a "show that" question they should show some substitution into F(t)

(c) The majority of students used the correct Normal Distribution with mean 112 and variance 63 (there were occasional but infrequent sightings of N(112, 112)). Most used the correct continuity correction with very few using 124.5 or 125. A minority of students the exact binomial and gained no marks as the question specifically said to use an approximation.

Question 3

(a) This part of the questions was well answered.

(b) There was clearly some misunderstanding among students as to the meaning of $\mathrm{P}(|R| > 3.5)$ with many students simply calculating P($R > 3.5$)

(c) The most common error made here was to draw the pdf rather than the cdf. Others found the function but omitted to sketch it and some who did sketch the graph did not put any of the required labelling on.

(d) (i) This part was fairly straightforward with many students who gained no credit in other parts of this question able to gain full credit here.

(d) (ii) This part of the questions was much more challenging. Many students found P(exactly one point being < 10 cm from the origin) rather than P(at least one point is more than 10cm from the origin). There were 2 different approaches used by the students who understood the question. Those who used 1 – P(none are greater than 10 cm from the origin) were more successful than those who attempted to add the probabilities of the three possible cases, i.e. P(1,2 or 3 points were more than 10cm from the origin) Those who used this second method often forgot to include the number of arrangements.

Question 4

(a) Students who used the method in the mark scheme generally achieved the correct answer in a few steps. Those who chose to do trial and error did so with mixed success.

(b) Quite a few students used $\lambda = 6$ for their H_0 etc As the question is testing the change in proportion the hypotheses should be written in terms of p. It was pleasing to see that only a few students used a one-tailed test. The majority of students used the probability method and were able to write or use $\mathrm{P}(X \ldots 11) = 1 - \mathrm{P}(X„ 10)$ to obtain 0.0426 and come to the correct conclusion. Those using the CR approach were generally less successful. A small minority of students used the binomial or the normal approximation.

Question 5

(a) The question indicated that the number of particles was modelled by a Poisson distribution so enabling most student to correctly find the mean of 50ml as 7.5 and calculate P(X = 10) correctly. However, part (b) was not so well done with the most common error was using $\mathrm{P}(X„ 11) - \mathrm{P}(X„ 6)$

(b) This part was very challenging for many. Those who were clear what their random variables were found this easier. i.e. X is the number of particles in m ml of solution and Y is the number of samples out of 12 with 'no particles'.

Question 6

(a) Students who used the given information $P(X < 4) = \frac{31}{45}$ were generally successful and found the correct value of k. However there were many students who ignored this information and tried to find k by finding $\int_0^2 0.1x dx + \int_2^4 kx(8-x)dx$and equating to 1 or adding the 3 integrals and equating to 1 and then not knowing how to deal with unknowns k and a. Others simply used $\int_2^4 kx(8-x)dx = 1$ and ended up with unwieldy values for k

(b) (i) Few students used the (area for $4„ \ x < 6$) to realise $2a = 1 - \frac{31}{45}$ and went back to first principles. However many did end up with $a = \frac{7}{45}$

(b) (ii) Again many students went back to first principles but with slightly less success due to there being more opportunities to make errors in their calculations.

(c) Whilst many students were able to gain full marks for this part, the usual errors were made. The most common errors were forgetting to add $\int_0^2 0.1t_{\mathrm{dt}}$ for the 1st method mark and not using $\frac{31}{45}$ for the second method mark. As this was given in the question the students were expected to use it and ft marks from incorrect expressions were not awarded the method marks.

Question 7

A student's success at these questions depended on the student reading that the sampling method was 'without replacement'.

(a) This part was the most challenging for the students. Many wrongly thought that P(A sample of 3 counters contains a 9) = P(obtaining a 9 when you select 1 disc) which led to 2 and 1.8 for mean and var. Those who realised that $Y \sim B(20,p)$ were normally able to use the correct method to find the mean and variance. Others wrongly found the mean of the score on a single counter.

(b) In this part the most common error was forgetting that to find the median you had to order the numbers. Many students wrongly thought that 8,7,9 gave you a median of 7.

(c) The main errors in this part were forgetting about the coefficients or using the wrong coefficients e.g. using a coefficient of 2 with 7,7,9 or a coefficient of 3 with 7,8,9. It was also common to see 9 included with a non-0 probability as students had forgotten that there is only 1 counter with the number 9 on. Many also had probabilities that didn't add to 1.

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