Pearson Edexcel

Examiners' Report
Principal Examiner Feedback

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

WST02 PE Report January 24

General Introduction

Overall, this paper allowed all students to demonstrate their ability and knowledge of the WST02 specification. There were several places where students struggled to translate the context into correct statistical processes/calculations. In particular questions that ask a student to show something is true require all the steps in the working to be shown.

Report on Individual Questions

Question 1

Part (a) was a nice easy start to the paper with many students showing that they were able to calculate the mean and variance of the given frequency table. However, it was surprising that some students were unable to calculate the variance. Common errors included finding $\frac{\sum x^2}{n}$ only or $\frac{\sum x^2}{n} - \bar{x}$.

Part (b) asked students to use their answer from part (b), so no marks were awarded if no values/non compatible values were calculated. Too many students failed to read the demand of the question and therefore it was not unusual for students to give conditions necessary for a Poisson distribution and no credit was given for this.

Part (c)(i) was answered well by students with many scoring both marks. The common errors seen was to find either $1 - \mathrm{P}(X \leqslant 3)$ or $1 - \mathrm{P}(X \leqslant 1)$ rather than $1 - \mathrm{P}(X \leqslant 2)$

Part (c)(ii) caused students more issues. Whilst many students scored both marks, too many calculated incorrect probabilities. The common errors seen was to find $\mathrm{P}(W \leqslant 7) - \mathrm{P}(W \leqslant 3)$ or $\mathrm{P}(W \leqslant 8) - \mathrm{P}(W \leqslant 4)$ or $\mathrm{P}(W \leqslant 8) - \mathrm{P}(W \leqslant 3)$

Part (d) allowed many students to gain some marks, with a number gaining full marks. Most students were able to state or use N(21, 21) and so gained the first B1. It was pleasing to see that many students applied a correct continuity correction (18.5), probably because the question was a show that question. However, some failed to use a continuity correction at all or some used an incorrect continuity correction and so lost marks. The fact that this did not lead to the answer they were asked to show should have made students review their solutions. As this was a show that question students should be encouraged to show all their working as many lost the final mark as they just stated 0.29 rather than showing that the answer was 0.29 correct to 2 decimal places.

Part (e) was answered well by students, with many scoring full marks.

Question 2

Part (a) was answered well by many students who gained full marks. There were 2 main errors made in this question. The first being that some students incorrectly thought that a continuity correction was needed and so lost 2 marks, whilst the other being that some students used an inaccurate z value (often 1.645). Students should be reminded that when z values are required then these must be 4 decimal places or better.

Part (b) was answered well by many students who gained full marks. A common error here was to use $1-\mathrm{P}(X \leqslant 2)$ rather than $1-\mathrm{P}(X \leqslant 3)$. A few students lost the final mark as they did not give an answer to the required degree of accuracy (0.034 rather than 0.0341 seen too often).

Part (c) was generally answered well by students. However, some failed to follow the demand of the question, which asked for a Poisson approximation to be used and so those students that used a binomial distribution scored no marks. Some students lost marks because they used a less accurate value for λ (Po(7) was the most common incorrect model stated, probably so that they could use tables rather than the required Poisson expression).

Question 3

Part (a) caused some students issues. The question asked for two assumptions in context, so it was surprising that some students only gave one assumption and others failed to give their assumptions in context. In this question the only two assumptions needed related to independence and a constant probability as the other two were suggested by the question. So, assumptions relating to a fixed number of trials or having only two outcomes gained no credit. Students should be encouraged to think about the assumptions needed with regards to information given.

Part (b) allowed students to gain some marks but only the best students scored full marks. The question told students that they should state the probability of rejection in each tail. Some students failed to meet this demand and so were unable to gain all the marks available. Some students gave a correct probability of rejection for the lower critical region but a common error for the upper critical region was to give a probability of rejection as 0.9876. Whilst this allows students to determine the correct critical region the probability of rejection is 0.0124 and so many lost the final A mark. Another common error seen included those students who gave their critical regions as probability statements. Students should be made aware of the difference between probability statements and critical regions.

Part (c) was answered well by many students with the vast majority scoring the 1 mark available here.

Part (d) was very hit and miss. Those that realised that Rowan's belief related to the null hypothesis gave a correct response. However too many assumed that Rowan's belief related to the alternative hypothesis and so gave an incorrect response.

Part (e) allowed students to score some marks at some point in this question. Many were able to state their hypotheses in terms of p, but a few either did not write hypotheses or used no/an incorrect letter. The majority of students took a probability route rather than a critical region approach and most scored M1A1. A few lost this mark as they calculated $\mathrm{P}(X = 8)$ rather than $\mathrm{P}(X „ 8)$ and so lost 2 marks. Most students could give a correct non contextual statement consistent with their probability or critical region. Conclusions were generally well written with the required context.

Question 4

In Part (a) many students were able to sketch the required probability density function with the required labels and so scored full marks. Common errors included drawing sketches that either touched the x axis or that joined at the point $x = 2$. A few drew a correct sketch but failed to have all the labels required so only scored 1 mark.

In Part (b) a variety of approaches were seen. The most successful usually took an integration approach. Many students were able to gain the first M mark as they were able to show a correct method for $\mathrm{P}(G „ 2)$ or $\mathrm{P}\left(G „ \frac{1}{2}\right)$ or $\mathrm{P}\left(\frac{1}{2} „ G „ 2\right)$. In most cases this was for $\mathrm{P}(G „ 2)$. The next 2 marks were then problamtic fo students. Many students failed to realise that $\mathrm{P}\left(\frac{1}{2} „ G „ 2\right)$ was required and often $\mathrm{P}\left(\frac{1}{2} „ G „ 3\right)$ was seen. This often caused students to lose these 2 marks. A few students did gain the 3rd M mark as they stated $\dfrac{\mathrm{P}\left(\frac{1}{2} „ G „ 2\right)}{\mathrm{P}(G „ 2)}$ even when this was not then used.

Part (c) allowed students to score some marks at some point in this question. Many were able to score the 1st M mark as they were able to correctly find $\mathrm{E}\left(H^2\right)$. A common error here was to fail to square 12 and so $2.4+12$ was often seen as an incorrect method. The next part of the question required students to find E(G). Those that followed the instructions in the paper (you must show your working clearly) often scored the next 3 marks. However, some students lost marks as failed to realise that $\int x\mathrm{f}(x)\mathrm{d}x$ was required on both functions. The question also stated that solutions relying on calculator technology are not acceptable and so students that failed to show the integration required lost 2 marks. Students need to make sure that show their integration and their substitution of limits to ensue that they gain these marks. Many students were then able to gain the last M mark as they knew that $\mathrm{E}\left(2H^2 + 3G + 3\right) = 2\mathrm{E}(H^2) + 3\mathrm{E}(H) + 3$ was required. However, a few lost this mark as they either failed to multiply E(H) by 3 or failed to add the 3 required.

Question 5

Part (a) was answered well by the majority of students. A common error seen when setting up the equation required included $\frac{(a+6)^2}{2} = 27$ or $\frac{(a-6)^2}{12} = 27$. Most students showed sufficient working to gain full marks but a few that took the quadratic route sometimes failed to reject $x = -24$ and so lost the final A mark.

Part (b)(i) and (ii) was answered well by the majority of students and many gained full marks.

Part (c) caused students more issues and only the better students were able to score full marks. Both methods highlighted in the mark scheme were seen with equal degrees of success. Many students that knew how to approach this problem often scored 2 marks as they could set up a correct equation for the required area. Quite often no further progress was made with this part of the question.

Question 6

Part (a) was answered well by many students and it was not unusual for students to gain at least 5 of the 6 marks available. The most common error made by students was to mix up the probability of odd with the probability of even. However students still managed to find the required probabilities albeit in the reverse order that was required. The P(X = 14) caused more issues than any of the other required probabilities and often $4\times\left(\frac{1}{5}\right)^2\left(\frac{4}{5}\right)^2$ was used rather than $6\times\left(\frac{1}{5}\right)^2\left(\frac{4}{5}\right)^2$.

Part (b) was answered well and many students scored full marks. Most took the route of solving using logs and a few had issues with the inequalities required. A common error was $n < \frac{\log(0.05)}{\log(\text{"}0.8464\text{"})}$ which led to an incorrect answer of $n = 17$

Question 7

Part (a) was answered well by those students that realised that they needed to differentiate the given function twice and for these students they often scored all 3 marks. Common errors include differentiating the given function only once or trying to integrate the given function. In both cases students were unable to arrive at the required answer.

Part (b) was answered well by many students and most seemed to know that they needed to use F(1) = 0 and correctly substituted to show that $a = 2$.

In Part (c) a variety of approaches were seen, all with equal degrees of success. Many scored the first M mark as they correctly found $k = \frac{1}{8}$. Again, many students correctly substituted 1.

4 and 1.5 into $F(x)$ and gained the next 2 marks. A few students lost marks as they gave inaccurate answers. Again, many students were then able to give a correct comparison and a conclusion. If marks were lost it was for either no comparison or no conclusion drawn.