Examiners' Report

Principal Examiner Feedback

Summer 2017

Pearson Edexcel International A-Level in Mathematics Statistics (WST03) 01

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General Introduction

Students were well prepared for the demands of this paper with particularly strong performances on Questions 1, 2, 4 and 7. At the top end questions 3 and 8 provided more discrimination. Care should be taken with written expression as questions which require explanation, such as 3(b), were not always sufficiently answered. Students must also take care when completing a hypothesis test to use correct notation for their hypotheses and sufficient context in their conclusions. Attention should be paid to giving answers to the degree of accuracy required by the question.

Report on individual questions

Question 1

Although the attempt at rankings caused slightly more confusion than usual, question 1 of this paper was generally well answered with more than half of students achieving full marks. In part (a), the rankings were mainly correct but some incorrectly used alphabetical order to determine the ranks. A few weaker students used the age of the parrot as the rank. Of those who did rank correctly, virtually all successfully calculated the Spearman's rank correlation coefficient correct to 3 decimal places.

In part (b) the vast majority of students chose an appropriate one-tailed test and used correct notation. On some occasions a two-tailed test was attempted. Most were able to identify the correct critical value for a test at the 1% level of significance. The decision to not reject H_0 was almost always correctly made and conclusions here were generally given in context.

Question 2

This was the most successfully answered question on the paper as more than 2/3 of students achieved full marks. Most students were able to set up correct contextual hypotheses in words though a small minority confused independence and dependence and gave the hypotheses the wrong way round. The instruction to give expected frequencies to 2 decimal places was generally heeded which meant most were able to calculate the χ^2 test statistic to the required degree of accuracy. On the whole, students chose the correct critical value by accurately finding the degrees of freedom. Again, most conclusions were given in context.

Question 3

Question 3's success rate was not as high as the first two on this paper as the quality of the answers in part (b) was poor and there were more difficulties with the hypotheses in part (a). Though a high proportion of students did correctly set up the hypotheses in part (a), one-tailed tests were not uncommonly seen. Others used $\bar{x}$ instead of μ. Some went on to make contradictory conclusions, i.e. that rejecting H_0 meant that the manager was correct.

In part (b), the most common mistake was to omit the word 'mean' from the description of the Central Limit Theorem's relevance. Most said that any sample was normally distributed. Students were very successful with part (c) as most correctly identified assumption that $s^2 \simeq \sigma^2$.

Question 4

Most students made a good attempt at this question. Part (a) was virtually always correct. Again, nearly all found a value for r to the required accuracy, but some students calculated $P(X = 8)$ instead of $P(X \geq 8)$ for s in part (b).

In part (c), many gave the estimated parameter in the hypotheses attempting to test whether Po (3.5) was a suitable model. This was penalised in the hypotheses but condoned in the conclusion. The next mistake came with combining the cells as a number of students combined 6, 7 and ≥ 8 giving an expected total greater than 10 rather than 5. Overall, there were many correct attempts at calculating the χ^2 test statistic. Many understood the need to subtract 2 from their number of cells to find the degrees of freedom and hence found a suitable critical value for the test. For those who had stated their hypotheses correctly, nearly all gave a sufficient conclusion.

Question 5

Question 5 of the paper saw a good overall response from students though some would benefit from giving more detail in their written answers. In part (a), most responses included the use of random numbers to select an appropriate number of dancers from each group. Some students did not adequately describe the three lists from which they were selecting the dancers. Those students just calculating the three sample sizes scored no marks. In part (b) most students know the advantages of stratified sampling but some responses were incomplete such as 'more representative'.

In part (c) most set up hypotheses in terms of population parameters using correct notation and made it sufficiently clear which mean applied to the intermediates and which applied to the beginners. There were some troubles with the null hypothesis as some students omitted the 3 and wrote $\mu_I = \mu_B$. The calculation of the standard error was done correctly by the majority of students with only a few forgetting take the square root of the expression. Again, for those who stated the hypotheses correctly, nearly all went on to give a correct contextual conclusion and score full marks.

Question 6

Question 6 saw many good solutions with nearly ½ of students scoring full marks here. The confidence interval was well attempted in part (a) of this question. Some students, however, did not give their answer correct to 1 decimal place as asked for in the question. Despite identifying the binomial distribution in part (b), a significant number of students incorrectly attempted $1 - P(X < 3)$. It was surprising to see such lengthy calculations in part (b) when the probability could have been easily found in the tables or from a calculator.

Question 7

This question allowed students at all levels to display their ability with top performers going on to achieve full marks. In part (a), there was little trouble finding the mean of the random variable A though there were more difficulties finding the variance. The most common mistake seen was division by 5 rather than 25. Mostly correct standardisations were seen with the only a minority of students dividing by their variance instead of their standard deviation.

Though a good start was made to part (b) with many correctly finding expressions for $\mathrm{E}(W - X)$ and $\mathrm{Var}(W - X)$, the final 4 marks of this part discriminated the most able students. Generally the attempts to standardise were correct but this was not always set equal to a z-value in the required range. The most frequent error was a lack of compatible signs (with $z = -1.2816$). Here students should have realised that the mean of W needed to be bigger than 30, so they should be reminded to check that their answer makes sense. At this level most recognise the requirement to set their standardisation equal to a sufficiently accurate z-value though less accurate values (i.e. 1.28 and 1.29) were still sometimes used.

Question 8

Question 8 was the most demanding question on the paper but it was pleasing to see students persevering and many went on to give clear, concise solutions. Part (a) was well attempted, but, despite calculating $\mathrm{E}(\bar{X})$, a significant number of students did not make any reference to this being biased. Particularly when the demand of a question is to ‘show that’, a conclusion is required. Part (b) was more successfully dealt with as most students subtracted α from their answer to part (a).

Though there were some very lengthy responses to part (c) and (d) which scored no marks, the most efficient solutions tended to be the most accurate ones. It is clear that some students find the concept of an unbiased estimator difficult, but for those finding a correct value of k in part (c), many were able to use it correctly in part (d) to estimate the maximum value of X.

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