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Mathematics MS2B

(Specification 6360)

Statistics 2B

Report on the Examination

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General

It was again very pleasing to see many fully correct solutions to all of the questions. However, parts of the questions that required a comment were not always well done, and it was disappointing to find a number of candidates unable to use straightforward GCSE techniques to enable them to produce correct solutions.

Candidates should realise that, when an answer is asked for in a specified form (eg exact, two significant figures or three decimal places), if they do not comply it is likely that they will lose marks. In certain questions, candidates often failed to write down sufficient method to enable them to gain full marks. Although the use of calculators is encouraged, total reliance on their use is not always best practice. Some candidates do not understand which hypothesis test they should use or whether they should use z-values or t-values in their calculations.

Question 1

On the whole, except for the more able candidates, the attempts at this question were very disappointing, especially as a similar question had appeared on a past paper. Using formulae given in the formula booklet and finding the area of a rectangle is all that was required, yet it seemed to be beyond the vast majority of candidates. In part (a), there seemed to be a lack of understanding of the concept of rounding errors. Although many candidates gave the correct lower value as 21.05, there were far too many who incorrectly gave the upper value as 21.14. Thus the correct values of 21.05 and 21.15 were rarely seen. A sketch indicating 21.1 ± 0.05 may have been useful. In part (b), the vast majority of candidates tried to work with widths and failed altogether to consider the distribution of rounding errors, X. Consequently, the overwhelming majority incorrectly thought that $\mathrm{E}(X) = \frac{1}{2}(21.05 + 21.15) = 21.1$ and that $\mathrm{Var}(X) = \frac{1}{12}(21.15 - 21.05)^2$. Although the latter often led to the correct numerical exact answer for the standard deviation, this method gained no credit. Very few diagrams of the required rectangular distribution of errors were seen. Some candidates, having obtained the correct variance by a valid method, failed either to go on to state the value of the standard deviation or did not comply with the request for an exact answer, often giving 0.0289. In part (c), although most candidates worked with an interval of 0.04, they were then unable to find the correct value of p = 0.4 with $0.04 \times \frac{1}{10} = 0.004$ often seen.

Question 2

There were very many excellent attempts at part (a)(i). The vast majority of candidates stated the correct hypotheses, with most then correctly realising that a z-test was required since the distribution standard deviation was known. However, some felt justified in using a t-test whatever the given scenario and these gained little credit. There are also some candidates who either stated a conclusion in context which is too positive or stated no conclusion at all. Part (a)(ii) was not well done, with many candidates failing to give a 'valid numerical reason' for their answers, and consequently gained no credit. There were many excellent solutions seen to part (b)(i). Unfortunately the instruction 'give the answers to one decimal place' was often ignored with the subsequent loss of a mark. Although the use of a calculator is encouraged, it must be deemed unwise to simply state a numerical answer obtained by such use without showing a valid method. A number of candidates simply stated a confidence interval and where this was incorrect they inevitably lost 5 marks. Part (b)(ii) was not well done, with many candidates stating that the mean was not in the confidence interval. This was not specific enough. It was required to indicate that the numerical value of the mean (61.4 which had to be stated) was above the upper limit (60.0) of the confidence interval and consequently the recruitment drive seemed to have had the effect of lowering the average age of the club members.

Question 3

Part (a) was designed to test candidates' understanding of the properties of a contingency table. This proved to be very popular, with the majority of candidates showing a good understanding and demonstrating good algebraic skills to often achieve full marks. In part (b), most realised that Yates' correction was required even if they could not apply it correctly in all cases. However, this did, as usual, prove to be a popular source of marks, even for those candidates who found part (a) beyond them.

Question 4

In part (a)(i), the vast majority of candidates correctly stated the distribution of X to be 'Poisson'. In part (a)(ii), although most stated the answers correctly as $\mathrm{E}(3X-1)=3\lambda-1$ and $\mathrm{Var}(3X-1)=9\lambda$, some, who seemed to understand the underlying concepts by stating $\mathrm{E}(3X-1)=3\times\mathrm{E}(X)-1$ and $\mathrm{Var}(3X-1)=3^2\times\mathrm{Var}(X)$, then failed to state their answers in terms of λ as requested, consequently gaining no marks. Part (a)(iii) proved to be very popular with most candidates. They were able to correctly state $\mathrm{P}(X=x+1)=\dfrac{\mathrm{e}^{-\lambda}\times\lambda^{x+1}}{(x+1)!}$ and then were able to use $\lambda^{x+1}=\lambda\times\lambda^{x}$ and $(x+1)!\ =(x+1)\times x!$ to prove the given answer. In part (b), it was very pleasing to see that candidates dealt with such phrases as 'at least 10' and 'at most 3' much better than in previous series. In part (b)(i), $\lambda=8.5$ followed by a correct calculation was often seen. In part (b)(ii), $\lambda=14.3$ was correctly seen and often used to find the correct answer of 0.00037. Unfortunately, some failed to comply with the instruction 'give your answer to two significant figures' and consequently lost a mark. Those who chose to do the whole of this part of the question on their calculators either gained full marks when the correct answer was stated or lost at least two marks for incorrect answers with no method shown.

Question 5

Most candidates were successful in completing the given table in part (a). Unfortunately, some then failed to calculate the value of $\mathrm{E}(N)$ as requested whilst others changed the 'given' values in Table 3, thus losing marks. In part (b), Table 4 was often completed but not always successfully. However, candidates in the main then realised that they needed to use the values found in Table 3 and Table 4 to help them to calculate the required probabilities in part (c)(i). This usually resulted in at least 3 marks being gained. Their result to part (c)(i) was then often correctly used in part (c)(ii), again with at least 3 marks being gained.

Question 6

Candidates need to realise that when asked to 'sketch' a given function, it need not be accurate but that the important features must be shown accurately. This time, fewer but still too many freehand drawings were seen, and some candidates did not give enough detail to gain full credit as they did not take enough care in making sure that the line segment joined $(1,\ 0.2)$ to $(5,\ 0.3)$ and was straight. Part (b) was often very well done, with many candidates gaining full marks. However, some did not give their answer in the exact form asked for and consequently lost a mark. It was disappointing to see some treating the distribution of X as discrete. Their attempt to find $\mathrm{E}(X)$, by constructing a table of values of p for x = 1, 2, 3, 4 and 5 gained no marks. In part (c), those candidates who correctly stated $\mathrm{F}(x)=\int_1^x \frac{1}{40}(x+7)\ \mathrm{d}x$, often managed to complete the proof successfully. Those who ignored these limits but correctly stated that $\mathrm{F}(x) = \int \frac{1}{40}(x+7)\,\mathrm{d}x = \frac{x^2}{80} + \frac{7x}{40} + c$ were less successful in arriving at the given answer. When this route was used, the calculation of the value of c by a valid method must be seen by using either $\mathrm{F}(1) = 0$ or $\mathrm{F}(5) = 1$ for full marks to be available. Working backwards from the given answer was not considered to be a valid method for finding the value of c. Candidates should realise that, when the answer is given, a full and comprehensive method must be shown in order to be able to achieve full credit. Part (d) was usually completed successfully, with most candidates able to solve the given quadratic equation in part (e). Again, some failed to comply with the instruction 'give your answer to three decimal places' and so lost a mark.

Mark Ranges and Award of Grades

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