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General Certificate of Education

Mathematics 6360
Statistics 6380

MS/SS1A Statistics 1A

Report on the Examination

2010 examination – January series

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Written Component

General

The average level of achievement on this paper was almost identical to the satisfactory standard achieved in the January series of both 2008 and 2009. Candidates appeared very well-prepared and generally knew what to expect. However, somewhat unexpectedly, parts of questions 1 and 3 proved a much greater challenge to many candidates than questions 5 and 6, with question 7 proving a major challenge to all but the best candidates. Most candidates made good use of their calculators' in-built statistical functions, particularly in question 3.

Question 1

Almost all candidates knew how to standardise, and so the overwhelming majority scored the 3 marks in part (a)(i); the remainder usually scoring 2 marks for finding $\mathrm{P}(X > 10.5)$. In part (a)(ii), again most candidates realised that a difference in areas was required, but calculating $\mathrm{P}(X < 10.5) - \mathrm{P}(X > 10.0)$ was all too common, as was the evaluation of $\mathrm{P}\left(Z < \frac{4}{3}\right)$ as $\mathrm{P}(Z < 1.3)$ rather than $\mathrm{P}(Z < 1.33)$.

Answers to part (b) almost invariably involved attempts at $\mathrm{P}(\bar{X}_6 > 10)$ instead of $\left(\mathrm{P}(X > 10)\right)^6$, this despite the fact that there was no mention of 'mean'. Consequently, the majority of candidates scored 0 marks.

Question 2

Almost all candidates scored at least 3 marks with many achieving 5 or 6 marks. There was a marked improvement, compared with previous papers, in the calculation of the median and interquartile range, although a small minority of candidates produced an incomplete solution by not finding the difference between their correct upper and lower quartile values. Incorrect answers were usually attributable to slips or omissions, particularly in respect of a and b, in ordering the data.

Part (b)(i) was the least successfully answered part. Incorrect answers included "a and b unknown" or "All values are different". Other answers such as "A large range" were unclear as to whether this applied to the 'data range' (not accepted) or 'many different values' (accepted). Answers to parts (b)(ii) were almost invariably correct.

Question 3

A score of at least 6 marks was the norm on this question. Over recent series, an ever-increasing proportion of candidates have made use of their calculators' inbuilt regression functions to find accurate values for a and b; thankfully interchanging these values is now a much rarer event. Some candidates used the formulae, and they often scored full marks, although there was a time penalty.

All candidates knew how to use their regression lines in part (b). Candidates continue to appear uncomfortable about interpreting residuals, with many ignoring the statement given in part (c) and referring instead to 'interpolation'. Those candidates who did refer to residuals sometimes commented that 200 fell between –415 and +430 whilst others merely stated that their answer in part (b) could be/was inaccurate rather than actually commenting on reliability. Others appeared to have difficulty in judging as to whether the residuals were (relatively) large or small.

Question 4

Better candidates were able to score at least 9 marks on this question but weaker candidates often failed to score more than 2 or 3 marks. Almost all candidates scored the 2 marks available in part (a)(i). Whilst many candidates also scored the 2 marks in part (a)(ii), a minority over-complicated the request by trying to evaluate 4 terms, although some were eventually successful. For a large proportion of candidates, part (a)(iii) resulted in a loss of 3 of the 4 marks available due to often-correct attempts at $\mathrm{P}(C = 2)$ instead of $\mathrm{P}(C \geq 2)$.

Here again some candidates over-complicated the request by trying to evaluate 6 terms rather than 3 for $\mathrm{P}(C = 2)$ or 7 terms rather than 4 for $\mathrm{P}(C \geq 2)$. Answers to part (b)(i) were often correct but the simple method for answering part (b)(ii), as $1 -$ part (b)(i), was sometimes not recognised; the lengthy alternative method often resulted in an incorrect answer.

Question 5

This was probably the best answered question on the paper with the better candidates often scoring the full 10 marks available. Apart from the small minority of candidates who found, by formulae, $\mathrm{P}(R = 7)$ and $\mathrm{P}(R = 10)$ in parts (a)(i) and (a)(ii) respectively, almost all candidates attempted to use the cumulative binomial tables in these parts. In part (a)(i), $\mathrm{P}(R = 7)$ was usually found correctly but, in part (a)(ii), some candidates used $\mathrm{P}(R \leq 11)$, instead of $\mathrm{P}(R \leq 10)$, whilst others forgot to subtract their values obtained from the tables from 1. Part (a)(iii) caused some candidates more difficulty, with many uncertain as to how to determine $\mathrm{P}(5 < R < 10)$. Whilst most candidates subtracted two cumulative probabilities, one or both were often incorrect values and, given that this type of question has appeared regularly on previous papers, calculations such as $\mathrm{P}(R \leq 9) - (1 - \mathrm{P}(R \leq 5))$ were particularly disappointing.

Most answers to part (b), based on using the binomial formula, were correct.

Question 6

Almost all candidates scored at least 2 marks on this question. Answers to part (a) were usually within the range necessary to score 2 marks; if not, they were within the wider range that scored 1 mark. Candidates were less confident in answering part (b), with a significant proportion of candidates quoting a value that indicated a strong correlation.

Question 7

Overall this was the worst answered question on the paper with most answers revealing a marked lack of understanding of much of the material examined. As a result, very few candidates scored more than about 5 marks. Answers to part (a) were generally very disappointing, with most candidates at best only able to score 1 mark for finding $\bar{t}$ as an unbiased estimate of μ. The fact that the 50 times needed to be a random sample appeared unknown to most candidates, as did the fact that $\dfrac{\sum(t - \bar{t})^2}{49}$ was an unbiased estimate of σ^2; knowledge of the latter is a key area for future improvement. Failure to determine, or even attempt to determine, an unbiased estimate of σ^2 inevitably had a knock-on effect in part (b), as almost all candidates, whilst aware of the formula required, obtained an inaccurate or, more often, a totally incorrect confidence interval. In part (c), most candidates realised that they needed to compare 60 minutes with their intervals, but many then failed to translate their comparisons into a correct statement about Wyn's belief. In part (d), candidates often made irrelevant statements about the sample size and, even when they realised that the sampling was from a population of times that was not known to be normally distributed, they failed to express this with sufficient clarity. Answers to part (e) revealed that an understanding of the correct interpretation of a confidence interval was not well understood. Common incorrect answers were 0, 1, or 0.99.

Coursework Component

There were a number of totals submitted that were incorrect due to errors in the addition of the marks from the strands on the Candidate Record Forms. This seemed to be more prevalent when internal moderation had been carried out on the forms themselves, but changes made had not been accounted for when totalling.

Centres should note that work should be posted to the moderator using a method which does not require a signature, as is explained in the AQA procedures.

The work sampled in this series was generally appropriately assessed. In some scripts there was still confusion over the application of the Central Limit Theorem. It is advisable for candidates to use/discuss unbiased estimators in their scripts, and this could be beneficial for the written paper as well.

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the **Results statistics** page of the AQA Website.