Version : 1.0 0110

AQA

General Certificate of Education

Mathematics 6360
Statistics 6380

MS/SS1B Statistics 1B

Report on the Examination

2010 examination – January series

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Set and published by the Assessment and Qualifications Alliance.

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General

The paper appeared to be found slightly more accessible than those of previous series. As a result, there was a noticeable increase in the proportion of scripts scoring high marks. Even the weaker candidates often found that they were able to score high marks on several questions. Candidates appeared very well-prepared and generally knew what to expect. However, somewhat unexpectedly, parts of some of the earlier questions on the paper proved a much greater challenge to many candidates than the later questions.

Most candidates made good use of their calculators' in-built statistical functions, particularly in questions 3 and 7. A minority of candidates, clearly with advanced statistical calculators, used in-built functions wherever possible throughout the paper to simply write down answers without any evidence of working. Many such candidates were penalised heavily for their incorrect answers and would have benefited from checking their answers or showing some working.

The most noticeable area in need of improvement was the interpretation of results and the judgement of their relative significance. For example:

- Question 3(c): Were the residuals (relatively) large or small?
- Question 6(c)(ii): Were the variances similar or different?
- Question 7(a): Was $r = –0.0355$ an indication of very weak correlation or no correlation?

Another less noticeable area for improvement was that of accuracy of final answers. Whilst some candidates give answers to an unreasonable number of decimal places, others round them too severely. Typical examples were:

- Question 3(b): $3911.359392\ldots$ (3911, 3910 or even 3900 are better)
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- Question 7(a): $–0.04$ (should be $–0.0355$)

Centres are reminded of the fifth instruction on the front of the examination paper.

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 4 marks, with many achieving 7 or 8 marks. This type of question has appeared fairly regularly of late, which may explain why there was a marked improvement in the calculation of the median and interquartile range. Incorrect answers were usually attributable to slips or omissions, particularly in respect of a and b, in ordering the data. A minority of weaker candidates attached the given values as frequencies to the numbers $1, 2, 3, ..., 15$.

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) and (c) were almost invariably correct with the latter usually obtained directly from calculators.

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.

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

Overall this was the worst answered question on the paper, with most answers revealing a lack of understanding of much of the material examined. As a result, very few candidates scored more than about 5 marks. Most candidates were able to construct a confidence interval for μ and so often scored 5 marks in part (a)(i). When marks were lost, it was usually for using an incorrect z-value or omitting $\sqrt{n}$; the latter was heavily penalised. Responses to parts (a)(ii) and (a)(iii) were surprisingly poor. In part (a)(ii), candidates often made irrelevant statements about the sample size and, even when they realised that the sampling was from a normal population, they failed to express this with sufficient clarity; “it”, “they”, “data”, “sample”, “flour” or “bags” were typical incorrect/unclear examples.

Many candidates appeared not to understand what was asked for in part (a)(iii). Answers often indicated a minimum weight rather than a minimum sample size and, even where a sample size was indicated, a range rather than a specific minimum value was quoted. Despite similar requests to part (b) on previous papers, many candidates failed to provide sufficient clarity in their responses. Thus “some” was not sufficient to indicate that 3 of the 12 bags weighed less than 1 kg. Candidates also needed to make it clear how their confidence intervals were being used in the context of the question, rather than merely making an often-incorrect theoretical statement such as “98% of all bags lie between … .” Answers to part (c) revealed that an understanding of the correct interpretation of a confidence interval was not well understood. Common incorrect answers were 0, 1, 0.1 or even attempts involving standardisation.

Question 6

This was probably the best answered question on the paper with the better candidates often scoring the full 14 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 $\mathrm{P}(R\le 11)$, instead of $\mathrm{P}(R\le 10)$, 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 $\mathrm{P}(R\le 9) - (1-\mathrm{P}(R\le 5))$ were particularly disappointing.

Most answers to part (b), based on using the binomial formula, were correct, although a small minority of candidates used $n = 14$ or 42 or even $n = 20$, presumably so that tables could be used. Determination of the mean and variance in part (c)(i) was carried out correctly by almost all candidates. However, many candidates struggled to express their comparisons of results using appropriate language. Phrases involving “correct”, “incorrect” or “exact” were not appropriate, and neither was the word “different” when comparing 1.43 to 1.50; rather the two values were “similar” or “about/nearly the same”.

Question 7

This final question was found surprisingly accessible with even the weaker candidates able to score at least 6 and sometimes upwards of 9 marks. Whilst there remains a small and ever-decreasing proportion of candidates who calculate the value of r using a formula, the vast majority used their calculators’ inbuilt correlation function. Using either method, the correct value was usually obtained in part (a), though a small minority of candidates omitted, to their cost, the minus sign. Most interpretations in part (b) were in context (1 mark) but a majority of candidates failed to appreciate that $r = -0.0355$ indicated “no correlation” and not “very weak negative correlation”. This latter phrase was not awarded the second mark available.

It was disappointing to see the poor level of accuracy in plotting points for part (c)(i), with one or more of particular points G, J and L causing problems. In part (c)(ii), most candidates noted that the points J and L were anomalous, but fewer mentioned that without them the correlation would be positive. In part (d), candidates were not thrown, as on a previous paper, by the notation S_{xx}, S_{yy} and S_{xy} and most used the given summary information to find the correct new value for r in part (d)(i). This value was then interpreted correctly in part (d)(ii) often using the phrase "(very) strong positive correlation".

Mark Ranges and Award of Grades

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