General Certificate of Education

Mathematics 6360
Statistics 6380

MS/SS1B Statistics 1B

Report on the Examination

2010 examination – June series

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Written Component

General

This paper turned out to be more demanding than was perhaps expected and, as a result, the average level of achievement, as measured by marks gained, was lower than on recent papers. Whilst a similar proportion of candidates to that on previous papers was able to achieve a gradable mark, a considerably smaller proportion than previously was capable of achieving high marks.

In general, candidates appeared well-prepared for most of the topics examined, particularly as regards those parts of questions that required calculations. Perhaps more so than on previous papers, those parts of questions that required non-numeric skills proved particularly challenging to many candidates. Indeed, the reduction in the proportion of high marks was primarily due to the perhaps less predictable parts of questions 6 and 7 which required candidates to display their skills in expressing assumptions, conclusions, interpretations and comments in clear and precise terms.

Most candidates provided sufficient evidence of working to permit the awarding of method marks even when an answer was numerically incorrect. Those candidates who attempted to maximise the use of their calculators' statistical inbuilt functions to determine normal and binomial probabilities and to construct confidence intervals sometimes needed to have a sounder knowledge of their calculators' capabilities when simply quoting answers.

The move to the new combined question paper and answer booklet appeared to have been a smooth transition for candidates.

Question 1

Most candidates scored full or almost full marks on this straightforward first question. The vast majority used the correlation function on their calculators to correctly find the value of r. Candidates from an ever-decreasing proportion of centres continue to calculate r by a formula, and they too were often correct. Almost all candidates identified that their value of r indicated a (very) strong correlation between weight and engine power, although a small proportion lost a mark for omitting to say it was also a positive correlation.

Question 2

The 4 marks available in part (a) were scored by many candidates. The mean and the standard deviation in part (a)(i) were frequently found correctly using their calculators' statistical functions with σ_d and s_d appearing as the answer in about equal numbers. A considerable proportion of candidates chose to re-calculate the values required in part (a)(ii) by adding 50 to each given data value, and it was somewhat surprising to see that they often gave σ_d in part (a)(i) but s_d in part (a)(ii) or vice-versa; this was not penalised. The method mark for the use of '$\times\ 1.22$' was frequently the only mark awarded in part (b).

Most candidates failed to consider the necessary p to £ conversion. Given that many nearby European countries have the euro as their currency, it was somewhat disturbing to see that UK candidates were apparently quite content with a bottle of water costing around 60 Euros!

Question 3

Most candidates achieved 3 or 5 marks in answering part (a). Almost all candidates knew how to standardise (without introducing an unnecessary continuity correction) and so the majority completed part (a)(i) accurately, but some then failed to apply the necessary area change correctly in part (a)(ii).

Candidates often scored either almost full marks or very few marks in part (b). Despite similar questions on previous papers, far too many candidates continued to perform a variety of standardisations and subtractions of areas for the 1 mark available in part (b)(i).

Few candidates answered part (b)(ii) correctly, despite a very similar request on the January 2010 paper. Some candidates with incorrect answers scored 1 mark for recognising the need to raise a probability to the power 6. Sadly, most attempts involved the standardising of the distribution of $\overline{X}$ and would have been good, even excellent, solutions to part (b)(iii) but in part (b)(ii) they gained no credit.

Those candidates who produced correct solutions in part (b)(ii) often then answered part (b)(iii) successfully. Of the many other candidates, some repeated their solution involving $\overline{X}$ to part (b)(ii) and so gained at least 2 and often 4 marks, whilst others were at a loss as to what to do given their work in part (b)(ii).

Question 4

This question on the binomial distribution was a good source of marks for many candidates, with the more able often scoring all the 14 marks available. Part (a)(i) was usually correct and the answer found from the appropriate table in the supplied booklet. A few candidates subtracted their correct answer from unity (giving $\mathrm{P}(M > 10)$) whilst a few others calculated $\mathrm{P}(M = 10)$ using the formula. Similar errors were seen in part (a)(ii), with $\mathrm{P}(M \le 5)$ and $\mathrm{P}(M > 5)$ being the most common.

Part (a)(iii) caused candidates more difficulty, with many being uncertain as to how to find $\mathrm{P}(6 < M < 12)$. Although most candidates did attempt to subtract two cumulative probabilities, they often selected incorrect values or sometimes even calculated $\mathrm{P}(M \le 11) - (1 - \mathrm{P}(M \le 6))$. The latter method was disappointing since this type of question has appeared regularly in the past. The vast majority of candidates used the binomial formula accurately in part (b).

Many candidates also scored full marks in part (c), whilst others only dealt with the male population. Most methods involved first finding the numbers of males and females, and then the respective number of left-handed of each gender, rather than treating it as a probability question. Thus it was quite well answered by even weak candidates.

Question 5

This was another good source of marks for candidates of nearly all abilities. Most candidates correctly multiplied the two probabilities to answer parts (a)(i) and (ii), although 0.03 was regularly seen as the answer to the latter. A common error in part (a)(iii) was to start afresh but to omit the case of both sows and so obtain 0.29 as the answer. Those who recognised the more efficient approach of $1 -$ (a)(ii) were nearly always correct.

In part (b)(i), most candidates completed the table correctly through simple arithmetic. The usual error was to find $\mathrm{P}(M') = 0.40$ and $\mathrm{P}(D') = 0.25$ correctly through subtraction but then to assume independence by calculating $\mathrm{P}(M' \cap D')$ as $\mathrm{P}(M') \times \mathrm{P}(D')$. Despite this making somewhat of a nonsense of the table's row and column totals, the allowing of follow-through answers from tables enabled mostly correct responses to part (b)(ii), although multiplication of two probabilities, rather than their addition, was a common error in the final part.

Question 6

Almost all candidates found accurate values for b (gradient) and a (intercept) using the regression functions on their calculators. Thankfully, the error of interchanging the two values had almost been eliminated. Some able candidates continue to calculate regression coefficients by formulae. In almost all such cases they were successful, but probably penalised themselves regarding time available to answer other questions.

In part (b)(i), many candidates drew their regression line through the intercept without realising that the x-axis scale was broken, whilst others appeared to think, mistakenly, that a line drawn by eye through $(\bar{x}, \bar{y})$ was sufficiently accurate. Comments in part (b)(ii) often noted that there was a positive correlation or relationship **or** (but not and) that there were at least two outliers or large residuals, although the level of language used sometimes made the meaning of the statements rather unclear.

In part (c)(i), it was not always the case that the new points for E and H were plotted correctly. Candidates were not fazed by the introduction of the S_{xx} and S_{xy} notation in part (c)(ii) and so almost all candidates found the new values of b and a correctly. The final comments, in part (c)(iii) about the new line, often referred appropriately to smaller residuals or lack of outliers for 1 mark but then merely observed that there was a positive correlation rather than revising their previous comments in terms of regression. As a result, the awarding of both marks was very rare.

Question 7

This question proved to be by far the most difficult in terms of marks scored. The explanations in part (a) were often incomplete. In part (a)(i), most candidates either did not even bother to calculate the value of $\bar{t} - 2s$ **as requested** or merely noted (guessed?) that it was negative. They usually followed this by stating that negative values of a normal random variable were impossible and made no reference to its implication of negative time in the given context. As a result, the majority of candidates scored 0 marks.

In part (a)(ii), some candidates noted that there '**was** a large sample' but most suggested that '**when** there is a large sample...'. Despite clarifying the statement of the Central Limit Theorem in the Examiners Report for June 2009, its relevance apparently remains a mystery to most candidates. Hence answers to part (a)(ii) usually scored 0 marks. However, a large majority of candidates knew how to find a confidence interval and most incorrect answers were due to either a wrong z-multiplier, using 19.3 rather than $\sqrt{19.3}$, or omitting $\sqrt{80}$.

Many justifications in part (c) were too vague. It was not unusual to see 8 compared with $\bar{t}$, instead of the upper confidence limit, and, although some candidates noted that there was one value in the sample 'above 20', few made a full comparison of 0.0125 with 5% or 0.9875 with 95%. Instead they referred to 98%, presumably from the confidence interval, or attempted to calculate $\mathrm{P}(T \le 20)$ using the $\mathrm{N}(6.31,\ 19.3)$ distribution, so ignoring their comments in part(a)(i).

Coursework Component

It is important that all centres read the advice offered on the feedback forms carefully; in particular if the form indicates that the centre is close to the tolerance limits as further drifting from the standard could lead to an adjustment in the centre's marks. As mentioned in previous reports, centres should remember that the moderator has no idea of the individual qualities of the candidates submitting the work; the marks must reflect what is submitted, not what the candidates have done in previous exams or class work.

Centres should ensure that all work is dispatched in appropriate AQA stationery, does not require a signature on delivery, and that the deadlines for submission are met. If a centre does have an issue with making a deadline, then they must contact AQA for advice.

There were some errors in the addition of individual strand marks when totalling scripts. This was usually after changes were made during the internal moderation process. Always check the totals carefully as errors are reported to AQA for adjustments to be made.

As mentioned in previous reports, there was a general lack of understanding of the Central Limit Theorem, especially in the context of the candidates' tasks. There is no need to take samples of size 2, then 3, etc to attempt to 'prove' the Central Limit Theorem or to see if the sample is normally distributed.

It is important that if candidates use IT in their scripts it should enhance, not detract from, their write-up. In a number of cases, poor use of symbols and poorly inputted formulae led to some candidates confusing themselves in their terminology and calculations.

Mark Ranges and Award of Grades

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