General Certificate of Education

Mathematics 6360
Statistics 6380

MS/SS1A Statistics 1A

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 expected and, as a result, the average level of achievement, as measured by marks gained, was slightly lower than on recent papers. Whilst a similar proportion of candidates to that on previous papers was able to achieve a gradable mark, a much smaller proportion than previously was capable of achieving high marks.

In general, most candidates appeared well-prepared for the topics examined, particularly as regards those parts of questions that required calculations. However, it was not unusual to see a candidate make no attempt whatsoever at a question, usually questions 3 or 6, thereby suggesting a total lack of knowledge of the topic. 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 5 and 6 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. Appropriate use was generally made of Tables 1 and 3 in the supplied booklet, although weaker candidates displayed the usual uncertainties for specific values or areas. The move to the new combined question paper and answer booklet appeared to have been a smooth transition for candidates.

Question 1

Most candidates got off to a good start on the paper by scoring high marks on this question. Almost without exception, answers to part (a) were correct. In part (b), weaker candidates were uncertain as to which two probabilities to subtract, with $\mathrm{P}(X \leq 14)$ and/or $\mathrm{P}(X \leq 10)$ used instead of $\mathrm{P}(X \leq 15)$ and $\mathrm{P}(X \leq 9)$. Most candidates answered part (c) correctly, usually by using the appropriate formula rather than tables.

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. 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 or quote their answers in cents rather than euros.

Question 3

Most candidates attempting this question on the normal distribution realised that, in part (a)(i), $\mathrm{P}(\text{not overflow}) = \mathrm{P}(X < 155)$ and the majority then obtained the correct answer. However, a minority of candidates changed $\mathrm{P}(X < 155)$ to $\mathrm{P}(X \leq 154)$ — a loss of 3 marks — or performed an unnecessary area change — a loss of 1 mark. Again, in part (a)(ii), the majority of candidates stated that $\mathrm{P}(\text{less than that printed}) = \mathrm{P}(X < 150)$ but a significant proportion then failed to carry out the necessary area change — a loss of 2 marks.

Answers to part (b) often scored 0 marks through the use of $z = \frac{152.5 - 152}{0.8}$. It was expected that, given similar requests on several past papers, candidates would be much better prepared for questions involving the distribution of the mean of a sample drawn from a normal population.

Question 4

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 sometimes 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 5

Almost all candidates found accurate values for b (gradient) and a (intercept) using the regression functions on their calculators.

In part (b)(i), some candidates drew their regression line through the intercept without realising that the x-axis scale was broken, whilst a minority 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. Most 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, sometimes referred appropriately to smaller residuals or lack of outliers for 1 mark but then stopped or 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 indeed.

Question 6

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 using 19.3 rather than $\sqrt{19.3}$.

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 $\mathrm{P}(T \leq 20)$ 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, and particularly so 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. Totals should always be carefully checked.

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.