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General Certificate of Education

Mathematics 6360
Statistics 6380

MS/SS1A Statistics 1A

Report on the Examination

2009 examination - June series

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Written Component

General

Most candidates appeared well-prepared for this paper and, as a result, the average level of achievement, both in terms of the average (raw) mark and the spread of (raw) marks, was in line with that achieved on recent papers in summer series. As intended, almost all candidates were able to make worthwhile attempts at most, if not all, of the six questions. However, a small minority of candidates appeared to have absolutely no knowledge of at least one of the topics examined, thereby scoring zero marks on one or more questions.

Most candidates were able to score well on each of the first three questions. They were then able to make often-worthwhile attempts at some, often all, of the final three questions, but often with an increasing loss of marks. In particular, all but the strongest candidates lost many of the 8 marks available for questions 4(b)(iii), 5(c) and 6(b)(iv). Candidates continued to make good use of their calculators' statistical functions in questions 2 and 4, and appropriate use of tables in questions 3, 5 and 6. On a less positive note, attention needed to have been drawn, in many cases, to instructions 1 and 6 on the front page of the question paper since it was not unusual to see:

- answers in blue ink or even in pencil;
- graphical work completed, often untidily, in ink rather than in pencil;
- anonymous unattached inserts.

Question 1

This relatively standard probability question enabled most candidates to score at least 7, sometimes 9 but rarely 11, marks. Full marks were usually scored in parts (a)(i) and (ii). Many candidates also scored full marks in the remainder of part (a) but it was not unusual to see an answer based upon $\frac{60+32}{160}$ for part (a)(ii) and/or answers based upon $\frac{18}{60}$, $\frac{48}{160}$ or even $\frac{30}{48}$ for part (a)(iv).

Fully correct answers to part (b) were rare. Although many candidates were able to construct the expression $\frac{24\times56\times32}{160^3}$ for 1 mark or the expression $\frac{24\times56\times32}{160\times159\times158}$ for 2 marks, few realised that permutations had to be considered. Of those who did, about half used 3 rather than $3! = 6$.

Question 2

The vast majority of candidates used their calculators' inbuilt correlation function to calculate the value of r. Using this method or using a formula, the correct value of r was usually obtained in part (a). Most interpretations in part (b) were in context and correct but a minority of candidates omitted the word 'positive'. In part (c), almost all candidates plotted the points correctly but significantly more did not label their plotted points.

Most candidates identified the two most likely female snakes in part (d)(i). A minority of candidates clearly re-calculated the value of r $(= 0.488)$ in part (d)(ii). Those candidates who estimated the value gave quite varying answers: some less than 0.25, others greater than 0.9. Accompanying interpretations were often comparative, using words such as 'weaker' or 'stronger', whilst others omitted the word 'positive'.

Question 3

Candidates were very well-prepared for part (a) and, as a result, most of them scored all 5 marks. Of the small minority who lost marks, the usual error was the use of an incorrect z-value. Here, the rounding of 1003.99 to 1003 or that of 1056.01 to 1057 were treated as irrelevant subsequent work and so were not penalised.

Many candidates scored the 2 marks in part (b) for a correctly reasoned comment on the claim. However, weaker candidates based their comments on a comparison of 1030 with their confidence intervals or suggested that the shovel always collected more than 1000 kg.

Question 4

Candidates appeared better prepared for part (a) than in the past, so their answers, usually directly from calculators, were in the main correct. It was also pleasing to note the large proportion of correct answers to parts (b)(i) and (ii). In the former, some candidates mysteriously obtained the correct answer despite totally incorrect work in part (a) and, in the latter, some answers were backed-up by a correct calculation.

In part (b)(iii), only the most able candidates were able to make valid statements as to why a normal distribution was not an appropriate model. Many invalid attempts made reference to the sample size or the Central Limit Theorem, neither of which had any relevance here. Candidates should be aware that, if X is normally distributed, then, for any sample size, the sample mean, $\overline{X}$, will be normally distributed regardless of the Central Limit Theorem; for other cases, the Central Limit Theorem states that, for sufficiently large sample size, the sample mean will be approximately normally distributed, but candidates should not infer from this that the population values, or actual sample values, will themselves be approximately normally distributed.

Question 5

In answering part (a), most candidates realised and applied the standardisation of $\frac{w-3.12}{0.08}$ and then substituted the values of 3.20 and 2.95. Perhaps through a reluctance to draw sketches, far too many such candidates then subtracted incorrect areas. A small minority of weak candidates simply treated 3.20 and 2.95 as z-values.

Most candidates were also able to make worthwhile attempts at part (b) by equating $\frac{3-3.12}{\sigma}$ to $+1.96$. Sadly such candidates then tried to hide or ignore the fact that their value of σ was negative. Better candidates used -1.96 or, often with explanation, changed at an early stage to $\frac{3.12-3}{\sigma}$.

Only the best candidates were able to score marks in part (c), and it appeared that many candidates were simply unaware of the variance of the sample mean. All too often, such candidates used the standardisation $\frac{3.15-3.12}{\sqrt{0.00375}}$ rather than $\frac{3.15-3.12}{\sqrt{0.00375/5}}$ and so scored zero marks. Some candidates using this incorrect standardisation, then calculated the 5th power of their probabilities, presumably to try to cater for the 5 boxes.

Question 6

Virtually all candidates used the appropriate binomial tables but frequently made one or more errors by finding $\mathrm{P}(R \leq 10)$ in part (a)(i) and/or using $\mathrm{P}(R \leq 9)$ or $\mathrm{P}(R \leq 5)$ in part (a)(ii).

Candidates appeared well prepared in the use of the binomial formula, with almost all scoring full marks in part (b)(i). However, answers to part (b)(ii) were very disappointing. All too often, candidates calculated $\mathrm{P}(S=1)$ or $1-\mathrm{P}(S=1)$ rather than $\mathrm{P}(S\geq 1)=1-\mathrm{P}(S=0)$, with some even using $n=22$ rather than 35.

In answering part (b)(iii), most candidates took note of the word 'correctly' and the number '120' in the question to then score both marks. However, a minority lost marks for stating answers of 7.2 or $2.60\left(\sqrt{6.768}\right)$. Part (b)(iv) proved beyond all but the high achievers. Whilst some candidates based their comments on the perceived practical difficulties in sorting letters, others decided that there was only one assumption and so made their comments unclear. Those candidates who did treat the statements as two separate assumptions, still often demonstrated little understanding of the implications of 'equal means' but 'different variances'. Many such candidates used the means to comment on independence and the variances to comment on the probability. As a result, the awarding of full marks for this final part was very rare.

Coursework Component

It is important that all centres read their feedback forms from the moderator carefully, as there is some evidence that the advice offered is not always being taken, leading to some centres having marks adjusted session upon session. It should be clear from the comments made what such centres need to do to avoid any further issues. The comments should also indicate if a centre is close to falling out of tolerance; in such cases careful internal moderation is strongly advised. 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 exams or class work.

Centres should ensure that all work is dispatched in appropriate AQA stationary and does not require a signature, 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 was a significant improvement this session in the 'other areas of work' strand, after the advice offered in previous reports.

The most popular task seen was 'authorship', but some of the scripts displayed a very poor understanding of the Central Limit Theorem. In fact, many wrote contradictory statements about the distribution of the population, sample and sample mean. Clear and correct statements would be expected for full marks in the theory strand.

Regression and correlation analysis in 'Is there a link' was also popular; a consideration of residuals would also be expected in the analysis and interpretation.

Mark Ranges and Award of Grades

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