General Certificate of Education

Mathematics 6360

MS04 Statistics 4

Report on the Examination

2010 examination – June series

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General

It was pleasing to see that the higher quality of work noted last year was maintained again this year. Good answers were produced, usually to the appropriate degree of accuracy, for all questions, thus showing evidence of generally good preparation. Substantial attempts were made at all questions, indicating that there was sufficient time to work through the paper.

Candidates made good use of the new style answer booklet and had plenty of space for their solutions. Statistical tests and calculations were performed accurately and clearly. The statement of hypotheses showed an improvement over last year. Similarly, comments after calculations were much more to the point than previously. Candidates continued to make good use of the appropriate formulae and tables in the booklet provided.

Question 1

This question was well done by the majority of candidates, and so most of them got off to a good start on the paper. The majority stated hypotheses correctly, but occasionally a candidate did not read the question quite carefully enough, writing $\mu_d = 0$ rather than $\mu_d = 0.2$.

Occasionally, a candidate also performed a 2-sample t-test instead of the required paired t-test. This error, sadly, cost a number of marks, but not disastrously so. Most candidates had the correct number of degrees of freedom and stated a conclusion, in context, correctly.

Question 2

Both parts of this question were done well and showed that the candidates had been well prepared for the topic. Errors were mainly minor, and candidates showed a good understanding of the work needed in both parts of the question. Since the degrees of freedom were equal in the F-ratio test in part (b), perhaps their task was a little easier than it might have been.

Question 3

This question was also answered well by the majority of candidates, with most producing accurate work. In part (b), the comment “independent random samples” gained only 1 mark. A number of candidates apparently thought that they would get 1 mark for “independent” and 1 mark for “random”. Consequently they often omitted to say that the samples had a common variance, and so lost a mark. Most candidates mentioned that the samples had to come from normal distributions, although some appeared to suggest that the samples were normal. The marks in part (c) were awarded on a follow-through basis, if an arithmetical error had produced the wrong confidence interval in part (a).

Question 4

Part (a)(i) caused considerable difficulties. Some candidates were unable to complete the proof because they could not sum the series $1+3q+6q^2+\ldots$. Nevertheless, they used the result to successfully answer part (a)(ii), thus showing good examination technique. Others overcame the problem by establishing results for $\mathrm{E}(X^2)$ and $\mathrm{E}(X)$, thus deriving the required result. The purpose of finding $\mathrm{E}(X(X-1))$ was to be able to go on to find the variance. The proof that was hoped for is in the notes that accompany this unit on the AQA website.

In part (b)(i), candidates sometimes required more than one attempt to produce the result but showed admirable persistence. It has to be said that some of the algebra employed here was unnecessarily laborious, largely because fractions nested in the numerators and denominators were not cleared.

There was some loose work with inequalities in the final part. Those candidates who obtained the correct result working with an equality, rather than an inequality, earned 3 of the available 4 marks.

Question 5

This question was answered better than any other question on the paper, with many candidates scoring full marks. The procedures were well understood and arithmetical accuracy was meticulous. Only the occasional candidate forgot to combine classes, where the expected values fell below 5, or looked up the wrong critical value of chi-squared from the tables.

Question 6

Candidates were able, in varying degrees, to obtain the majority of the first 9 marks for this question. Understanding of the work on estimators was generally sound, although there were possibly a few lapses in concentration towards the end of the paper. For example, the distribution of $\overline{X}$ should be well known from earlier work. Attempts at part (c)(ii) were rather disappointing. Although this type of question has not appeared on previous papers, there is a similar example, involving a different distribution, in the notes that accompany this unit on the AQA website.

Mark Ranges and Award of Grades

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