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General Certificate of Education

Mathematics 6360

MS04 Statistics 4

Report on the Examination

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General

The overall standard of work was of a better quality than that produced by candidates in recent years. Good answers were produced, usually to the appropriate degree of accuracy, for all questions, showing evidence of generally good preparation. It was pleasing to note that the mathematical insight of this year's candidates appeared somewhat greater than that of candidates on previous papers.

Statistical tests and calculations were performed accurately and clearly, although the statement of hypotheses using correct notation often left something to be desired. There was also some difficulty in making comments after calculations, or stating necessary conditions for calculations to be performed. However, 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 got most of them off to a good start on the paper. Here, as mentioned above, there was some difficulty in stating the hypotheses using correct notation. The examiners expected to see $\mathrm{H}_0 : \mu_d = 0$ and $\mathrm{H}_1 : \mu_d > 0$ but certainly not the use of sample means. Almost inevitably, there was the odd mistake with the degrees of freedom. Conclusions, in context, were usually correct, and the mark could be earned on a follow-through basis.

Question 2

This was the least well-done question on the paper. In part (a), very few candidates could state more than one correct condition; some none at all. In part (b)(i), it was not unusual to find candidates unable to express the given information correctly as an equation in p, the probability of success in a single trial. Those who managed this sometimes failed to solve the resulting quadratic equation correctly. In part (b)(ii), provided that a candidate's p-value from the previous part was contained within the interval $(0, 1)$, then a follow-through mark could be obtained.

Question 3

The work on this question was pleasingly accurate. Minor errors did occur in identifying the number of degrees of freedom and the corresponding χ^2-values, or by using the wrong level of confidence, despite 98% being clearly stated in the question. In part (b), some candidates gave the correct assumption, namely that the sample was from a normal distribution, but others gave either an incorrect assumption or no assumption at all.

Question 4

Most candidates were able to state the values of $\mathrm{E}\left(\bar{X}_A\right)$ and $\mathrm{Var}\left(\bar{X}_A\right)$ correctly. In part (b)(i), the answers were stated in the question, so a complete solution was required for the marks to be awarded. This completeness was not demonstrated by a small proportion of candidates. However, most were able to find $\mathrm{E}\left(\bar{X}_M\right)$ correctly, but some failed with $\mathrm{Var}\left(\bar{X}_M\right)$.

Such candidates were usually able to repeat the procedure for X_L in part (b)(ii). A good proportion of candidates were able to calculate the relative efficiency correctly in part (b)(iii). However, some comments failed to score the final mark available, possibly due to confusion between what $\mathrm{RE} < 1$ or $\mathrm{RE} > 1$ implied. Other candidates avoided this problem by referring to a comparison of the sizes of the two variances.

Question 5

This question was answered well by most candidates, but perhaps not to the same high standard as in previous questions on this topic. Parts (a)(i) and (ii), which were synoptic work, sometimes resulted in the loss of one or both marks. In part (b), marks were lost for a variety of reasons: calculating expected frequencies to the nearest integer, rather than to at least one decimal place; not combining classes when expected frequencies were less than 5; stating incorrect degrees of freedom; using the wrong level of significance. The final mark for the conclusion was often obtained, albeit sometimes on a follow-through-basis.

Question 6

This question was answered well by all but the weakest candidates. Pleasingly, there was little confusion between variance and standard deviation, something that had occurred on previous papers. Most candidates acquired both marks in part (a). In part (b)(i), marks were lost due to a confusion between ν_1 and ν_2, or by interchanging F_{upper} and F_{lower} in the calculation. There were, however, many correct answers on this challenging topic, something which was good to see. Comments in part (b)(ii) sometimes lost the final mark by referring to 0, rather than 1, being outside the confidence interval.

Question 7

The mathematical skills of most candidates were well able to cope with the pure mathematics involved in this question. In part (a), a lack of detail was evident in the answers. To gain both marks it was necessary to state $\mathrm{F}(x)=1-\mathrm{e}^{-\lambda x}$ for $x \geq 0$ and $\mathrm{F}(x)=0$ otherwise; simply stating $\mathrm{F}(x)=1-\mathrm{e}^{-\lambda x}$ only obtained 1 mark.

Many candidates were able to find the two quartiles and hence the interquartile range in part (b). In part (c)(i), limits were required for the integration in order to score marks and, in fact, most candidates did use definite integration. As was the case in question 4, some lost the final mark for not showing a complete solution. Part (d)(i) was usually done successfully by using the printed answers but, in part (d)(ii), some candidates lost the final mark for an imprecise statement such as “it gets smaller”.

Mark Ranges and Award of Grades

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