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Mathematics MS04

(Specification 6360)

Statistics 4

Report on the Examination

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General

As in recent series, the quality of work continued to be of a generally acceptable standard. Good answers were produced for most questions, usually to the appropriate degree of accuracy, so showing evidence of generally good preparation. Substantial attempts were made at all questions, indicating that students had sufficient time to work through the paper. Students continued to make good use of the new style answer booklet which had plenty of space for their solutions, and they also made good use of the appropriate formulae and tables in the booklet provided. Hypotheses were usually stated correctly, and requisite tests and calculations were generally performed accurately and clearly. Unusually this year, when stating conclusions for tests, some students thought that they were testing H_0 under H_1 rather than the converse, whilst a similar number stated conclusions too positively.

Question 1

This first question was well done by the majority of students and so most got off to a good start on the paper. The majority stated hypotheses correctly. The occasional student made a small slip in calculating the pooled estimate of variance. The method for calculating the test statistic was well known and the number of degrees of freedom and the appropriate critical value were invariably correct. The conclusion was usually correct and in context.

Question 2

In part (a), most students were able to find the confidence interval accurately. In a small number of cases a confidence interval for the variance was calculated, which underlines the importance of reading questions carefully. In part (b), it was pleasing to note that there was little confusion over the degrees of freedom. As a result, the test was usually done well and, as in Question 1, the conclusion was usually correct and in context.

Question 3

As in previous series, the performance on a chi-squared goodness of fit test showed a high standard of understanding and accuracy. Surprisingly, at this level, not all students negotiated part (a) completely correctly. This did not prevent progress, as the required *p*-value was given in the question. In part (b), expected frequencies were usually calculated with sufficient accuracy in order to achieve an accurate test statistic in part (c). The great majority of students combined classes and used the correct number of degrees of freedom to find the appropriate critical value for the test. As with the other tests, the conclusion was usually correctly stated and often referred to the null hypothesis which was sometimes difficult to find as it was embedded in other working. Answers to part (d) were much less sound with few students able to provide a convincing answer.

Question 4

A partial answer, referring to 'efficiency' was usually given to part (a) and this earned one of the two available marks. Performance on part (b) of this question was often weak. Part (b)(i) was done rather better than part (b)(ii), but even here marks were lost. The difficulty in part (b)(ii) seemed to be the realisation that $n_2 = n - n_1$, which enabled the expression for the variance to be differentiated and so establish the condition for the variance to be a minimum. Given that this condition was printed in part (b)(ii), it should have been possible for students to obtain both marks in part (b)(iii); this, however, was not always the case.

Question 5

Most students were able to express $\mathrm{E}(X^2)$ correctly as an integral in part (a). They then realised that, to evaluate the integral, they needed to differentiate by parts (twice). The standard of work was generally good with few errors. Those errors that did occur usually involved signs or missing brackets. Some students, who made integration errors, were awarded a mark for showing correct working for the variance, based on their knowledge of the exponential distribution. Part (b)(i) required students to 'derive' the distribution function. If it was merely quoted, then one mark only was awarded. Most students knew the appropriate technique, using logarithms, to solve part (b)(ii) correctly. A similar number had a reasonable idea of what was required in part (c) and so there was a good proportion of correct answers.

Question 6

The summation of the series in part (a)(i) caused difficulties for the small number of students. These students attempted to sum using the standard result for a geometric progression, but usually made little progress. The majority, however, realised that they needed the binomial series $(1-q)^{-2}$. Part (a)(ii), however, could be done using information given in the question and in the formula booklet. There were good answers to part (b), with a number of correct answers.

Mark Ranges and Award of Grades

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