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General Certificate of Education

Mathematics 6360

MS03 Statistics 3

Report on the Examination

2008 examination - June series

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General

The overall standard of attainment on this third MS03 paper was most impressive and exceeded markedly that achieved on the two previous papers. Whilst the paper may have been deemed to be slightly less demanding than that in June 2007, it was clearly evident that the great majority of candidates had been very well-prepared for most of the topics examined. Centres are to be congratulated on this high level of achievement by their candidates. This was illustrated by 60% of candidates scoring at least 60 (raw) marks whilst only 5% were unable to score at least 30 (raw) marks.

The only question that caused significant problems and thereby a loss of marks to many candidates was Question 5, which required a confidence interval for the difference between two Poisson means using a normal approximation. Centres may wish to refer to the notes on this topic that are available at http://www.aqa.org.uk/qual/gceasa/mathematics_teach.php

Question 1

As expected, this question gave most candidates a confident start to the paper with most scoring at least 6 of the 7 marks available. When full marks were not scored, it was either for not stating (correct) hypotheses or, more often, for stating definitive conclusions in part (c).

Question 2

There were no errors of note in the answers to part (a) with almost all candidates scoring full marks. However, in answering part (b), most candidates stated correctly that 60% or 0.6 fell inside their confidence interval but then concluded incorrectly that the claim could be accepted. For this to be a correct conclusion, the lower confidence limit would have needed to be greater than 0.6.

Question 3

Very few errors were seen in answers to this question. A small minority of candidates either omitted hypotheses or stated them in terms of $\bar{x}$ rather than μ, or attempted to pool the population variances; something that is incorrect.

Question 4

Most candidates drew adequately a correct tree diagram but very few multiplied the probabilities (eg 0.25×0.30) which of course should, in total, add to one; there was no penalty for this 'omission'. However, almost all candidates did the necessary multiplications when answering part (b) correctly and so scored all 4 marks available. Answers to part (c) were much less impressive. Whilst the majority of candidates recognised the need for a binomial model with $n=10$, most then used $p=\{(\text{b})(\text{i})\}$, 0.15 or 0.55, rather than $p=\{(\text{b})(\text{ii})\}$, presumably through not recognising the conditional nature of the request.

Question 5

As mentioned earlier, this question caused the majority of candidates considerable problems. Whilst most recognised that a normal approximation was required in part (a), candidates invariably used an incorrect expression for the variance of their point estimate. Thus, when working with means, $(18-15)\pm1.96\sqrt{\frac{18}{184}+\frac{15}{184}}$ was expressed as $3\pm1.96\sqrt{33}$ and, when working with totals, $(3312-2760)\pm1.96\sqrt{3312+2760}$ was expressed as $552\pm1.96\sqrt{\frac{3312}{184}+\frac{2760}{184}}$ and then no attempt made to divide by 184. When attempted, the

usual answer in part (b) included “random samples” rather than “calls from A and B are independent”. As a result most candidates scored at most 3 marks on this question.

Question 6

This question was surprisingly well-answered particularly as somewhat less involved questions on the same topic had posed major problems to many candidates on previous papers. Indeed, it was by no means rare to see a candidate scoring all 18 marks. Most candidates recognised the need to first find $\mathrm{Cov}(X, Y)$ in part (a)(ii) but a small minority of candidates fudged their attempt at the given answer and so usually lost 3 marks; otherwise full marks were commonly scored in parts (a) and (b). This was followed by correct answers in part (c)(i). However, in part (c)(ii), some candidates were unable to translate the request into $\mathrm{P}(M < 0)$ and so scored virtually no marks. Of the many candidates who did deduce $\mathrm{P}(M < 0)$ was required, about 25% confused areas during standardising and so in fact obtained $\mathrm{P}(M > 0)$, resulting in a loss of 2 marks.

Question 7

In part (a)(i), many candidates lost at least 1 mark for a less than completely convincing proof, but most scored full marks in part (a)(ii). Most candidates also obtained correct values in part (b)(i) but, in part (b)(ii), it was not unusual to see $\mathrm{Var}(F)$ expressed as $2 \times 5 + 10 = 20$ or $2^2 \times 5 + 10 = 30$, both of which scored no marks. Due to correct answers in part (b)(i), most candidates gave the correct reason for variable D in part (b)(iii). However, a correct reason for variable F proved the most difficult mark to obtain on the paper. Those candidates who had answered part (b)(ii) correctly usually had statements indicating that $\lambda = 20$ was too large. Expected answers were “values less than 10 impossible” or “odd values impossible”. Answers to part (c) were, in the main, very sound and the awarding of 6 marks was quite common. When marks were lost, it was generally for standardising 174.5 or 175 rather than 175.5 or finding $\mathrm{P}(\mathrm{Z} < 0.58)$ when $\mathrm{P}(\mathrm{Z} > 0.58)$ was required. For some candidates this was their second such error; the first occurring in part (c)(ii) of Question 6.

Mark Ranges and Award of Grades

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