General Certificate of Education

Mathematics 6360

MS03 Statistics 3

Report on the Examination

2010 examination – June series

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Set and published by the Assessment and Qualifications Alliance.

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Registered address: AQA, Devas Street, Manchester M15 6EX

General

Overall, this paper proved considerably more demanding than that of previous series. Whilst a similar proportion of candidates to that on past papers achieved last year's grade E mark, far fewer than on past papers were able to obtain a comparable grade A mark.

In general, most candidates found the first five questions accessible, although weaker candidates had significant problems with parts of questions 4 and 5. However, it was disappointing to see the number of otherwise very able candidates failing to score even reasonable marks on questions 6 and 7. This was usually due to apparently ignoring the instructions in question 6, and poor algebraic and deduction skills in question 7.

Question 1

As expected, this standard question caused few candidates any problems, with the vast majority scoring full marks. When marks were lost, it was usually for either expressing hypotheses in terms of r, rather than ρ, or using a 1-tailed, rather than a 2-tailed, test.

Question 2

Again, this standard question was answered well by most candidates. In answering part (a), most candidates gained full or almost full marks. They used a correct expression (not involving the pooling of variances) and then substituted correct values for means, variances and z. A very small minority of candidates used s instead of s^2. Most candidates then answered part (b) correctly by indicating that their confidence interval excluded zero. Again in part (c), the mark was scored, often by reference to price or quality.

Question 3

In general, answers to this question showed a marked improvement over those to similar questions on previous papers, with 6 or 7 marks not at all unusual. Hypotheses were often correctly expressed — although $T = S$ etc was not acceptable — and a correct critical value stated.

The most common error was not to obtain a pooled estimate of λ by calculating $\hat{\lambda} = \frac{940 + 1560}{40 + 60} = 25$: a loss of 1 mark. Conclusions were sometimes too definitive, for example "Tina's claim is correct".

Question 4

In part (a), most candidates drew a correct tree diagram, even if somewhat untidily, but very few multiplied the probabilities (eg $0.10 \times 0.90 = 0.09$) which of course should, in total, add to unity; there was no mark penalty for this omission, but some candidates subsequently lost marks through their inaccurate multiplications of decimals. Answers to part (b)(i) were surprisingly weak with, for example, the answer to (A) as $0.02 + 0.0016 = 0.0216$.

Follow-through answers to part (b)(ii) often scored full marks, although some candidates either multiplied by 1000, instead of $10\,000$, or ignored "to the nearest 10". Almost all candidates recognised the need to use Bayes' Theorem in answering part (c). Although there were some fully correct solutions, too many candidates forfeited even follow-through marks through inaccurate arithmetic: surely something that should not occur in a Further Mathematics paper, especially where calculators are permitted.

Question 5

Sadly, the general improvement in candidates' abilities to answer questions involving linear combinations of dependent random variables was reversed this time, and many answers suggested that no reference had been made to page 10 of the supplied booklet.

In part (a), whilst $\mathrm{E}(T)$ was evaluated correctly, when attempting $\mathrm{Var}\,(T)$, all too often candidates ignored $\mathrm{Cov}(W, H)$, using ρ_{WH} alone or with a multiplier of 20 instead of $8\sqrt{20}$. Consequently, at least 1 accuracy mark was also lost in part (b), but here far too many candidates lost a method mark and more accuracy marks for considering the variable to be $4T$ instead of $\sum_{i=1}^{4} T_i$.

Some candidates showed little or no evidence of working but simply stated an incorrect answer and so scored few if any marks.

Question 6

There were one or two fully correct answers to this question but, in the main, candidates scored fewer than half of the available 18 marks. Answers to part (a)(i) were invariably worthy of full marks. Lack of thought often resulted in candidates scoring no marks in part (a)(ii) as only the best candidates recognised that the council's claim of 'more than 80 per cent' had to be changed to 'less than 20 per cent'. Even those candidates who did this often then incorrectly supported the claim, as their confidence interval included 0.2.

In answering part (b)(i), the vast majority of candidates either ignored the phrase "Using an exact test" or considered the associated test which involves the normal approximation to be exact. Whilst a generous maximum of 4 out of 5 marks was still available in part (b)(i), subsequent answers to parts (b)(ii) and (iii) could gain at most 1 mark for a correct general definition of a Type II error.

Question 7

Apart from a little fudging in part (a)(i), answers to part (a) were generally sound, with most candidates scoring 4 or the full 5 marks. However, even attempts at answering part (b)(i) were very rare with only the best candidates making any headway. Whilst completely correct answers were seen to something perhaps typical of 'stretch and challenge', even those candidates who wrote down expressions for $\mathrm{P}(X = m)$ and $\mathrm{P}(X = m-1)$ then appeared not to have the simple algebraic skills necessary to solve either an inequality or even an equality.

Most candidates also appeared unable to use the given result in part (b)(i) to answer part (b)(ii) as, although they could write down an expression for $\mathrm{P}(X = m \mid \lambda = 4.9)$, they were unable to deduce that $m = 4$.

In part (c), many candidates realised that the approximate distribution was $\mathrm{N}(240.25, 240.25)$ but then attempted $\mathrm{P}(Y > 240.25)$ or $\mathrm{P}(Y > 239.75)$. Again, they apparently failed to realise that *d* must be an integer and that, using the given result in part (b)(i), it must equal 240 and so $\mathrm{P}(Y > 239.5)$ was required.

Mark Ranges and Award of Grades

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