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ASSESSMENT and QUALIFICATIONS ALLIANCE

## General Certificate of Education

# Mathematics 6360

## MS04 Statistics 4

# Report on the Examination

*2007 examination - June series*

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## General

The overall standard of work by candidates was somewhat below the very high quality reached on last year's initial paper. All questions elicited some very good answers that showed evidence of sound preparation. Answers were given to the appropriate degree of accuracy and fewer 4 or 5 figure answers were seen this year. The relevant knowledge from pure mathematics was still a problem for some of the weaker candidates. However, good use was made of appropriate formulae and tables in the booklet provided.

## Question 1

This proved to be a good starter question. Most candidates were able to obtain the majority of the marks. The most common error was not realising the need to find both critical values. The correct value of $\chi^2_{\text{calc}}$ fell below the lower critical value, causing the null hypothesis to be rejected. Pleasingly, most candidates now give their conclusion to hypothesis tests in the context of the question.

## Question 2

In part (a), many candidates were unable to formulate the equation correctly and produced an equation indicating that the variance was four times the mean, whereas the question stated that the mean was four times the variance. They were, however, then able to answer the more demanding part of the question quite well by using their false value of $p$. The ability to cope with conditional probability was pleasing. A number of candidates, rather than getting bogged down with geometric progressions, would have benefited from knowing that $\mathrm{P}(X > r) = q^r$ for the geometric distribution.

## Question 3

A number of candidates performed a two-sample $t$-test rather than the requested paired $t$-test. This immediately restricted them to approximately half of the available 10 marks. Those candidates who were undertaking the correct test usually managed to complete it almost entirely correctly. However, minor errors with hypotheses, degrees of freedom or critical values did occur in some instances. In part (b), most candidates gained a mark for stating that the samples were random, but few stated correctly that the differences had to be normally distributed.

## Question 4

Part (a) produced considerable variation in the responses. Weaker candidates used incorrect limits, or omitted the limits completely, and sometimes candidates showed little knowledge of integration by parts. The more able candidates showed impressive knowledge of how to handle infinite integrals. As this is an applied unit, a somewhat informal approach, without the rigours of pure mathematics, to infinite integrals is acceptable. The specification requires candidates to know the form of the cumulative distribution function for the exponential distribution. Those who did were able to carry out the calculations in parts (b)(ii) and (iii) without any great difficulty. Again, the ability to deal with conditional probability was evident in part (b)(iii).

## Question 5

This was probably the best-answered question on the paper. When marks were lost, it was generally in the details. These included not combining classes to obtain expected frequencies >5, not ensuring that expected frequencies totalled 100, occasional lapses in arithmetic, wrong degrees of freedom and errors with the critical value for the test. With so many places in which to make a small error, the number of completely correct solutions was impressive.

## Question 6

Part (a) was done well by the majority of candidates, however mistakes began to occur in part (b). The most noticeable of these was where candidates started subtracting when dealing with the variances. The result $\mathrm{RE}(T_1 \text{ wrt } T_2) = \dfrac{\mathrm{Var}(T_2)}{\mathrm{Var}(T_1)}$ is part of the specification and some candidates did not use it. Some of those who calculated it correctly were not sure of its significance and so stated that $T_1$ was preferred as it had the smaller variance. This scored one mark. However the question asked candidates to use the result from the previous part and in order to score both marks, candidates should have stated that, because the relative efficiency was greater than $1$, $T_1$ was preferred.

## Question 7

This question also produced a range in the quality of answers. Weaker candidates were able to score marks for calculating variances and finding $F$-values from tables. However, the intricacies of reciprocals and inequalities then prevented them from correctly finding the appropriate confidence interval. Completely correct answers to part (b)(i) were obtained, some by rather laborious methods, but others by concise and impressive work. As with other questions where candidates were called upon to comment on their results, marks were lost in part (b)(ii) by candidates' not giving a full enough answer.

## Mark Ranges and Award of Grades

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