Version : 1.0 0107

ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Education

Mathematics 6360

MS2A Statistics 2A

Report on the Examination

2007 examination - January series

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Written Component

General

It was again very pleasing to see so many excellent solutions to each of the questions on this paper. It was evident from the standard of work seen that candidates, on the whole, had been well prepared for this examination. Hypotheses were quoted appropriately, correct tests were used and conclusions were given in context. Most problems usually occurred in the continuous variable question through some candidates' inability to integrate correctly or through their non-use of the most efficient methods.

Question 1

This question was very well answered, with the majority of candidates gaining full marks. In part (a)(i), some candidates quoted $\mathrm{P}(X < 3) = \mathrm{P}(X \le 2)$ and then used the tables incorrectly, often looking up $\mathrm{P}(X \le 3)$, presumably by mistake. Part (a)(ii) was done well by most candidates. The interpretation, in part (b), of "at least 4" was much better understood than in previous papers although there were still a few candidates who found this difficult.

Question 2

This was a popular question, which resulted in the majority of candidates gaining full marks. Almost all of them realised that the data were a small sample from a normal distribution with unknown variance and therefore they had to use Student's *t*-distribution with 7 degrees of freedom to obtain the required critical value of $t = 3.499$.

Question 3

The vast majority of candidates managed to gain full marks on this question. The usual errors in the calculation of s or s^2 from summary data were still seen, with $s = \sqrt{15321}$ being a popular misconception. The null and alternative hypotheses were usually stated correctly. However, a few candidates thought that it is sufficient to write "$\mathrm{H}_0 = 85.9,\ \mathrm{H}_1 \ne 85.9$" or "$\mathrm{H}_0 : \text{mean} = 85.9,\ \mathrm{H}_1 : \text{mean} \ne 85.9$", neither of which was acceptable. Since it was a large sample size, it was expected that candidates would use a *z*-test with critical values of ± 1.96, although the use of $t = \pm 1.984$ was clearly an acceptable alternative.

There were still candidates who insisted on being far too dogmatic when drawing their conclusions. Statements such as "This proves that the mean has not changed" or even "The mean has not changed" were the usual responses from weaker candidates, whereas "Insufficient evidence to suggest that the mean has changed from 85.9" was the type of response required and often seen from the more able candidates.

Question 4

Candidates found this question very much to their liking, with the vast majority gaining full marks. Most candidates easily obtained 0.05 for the value of *k* in part (a), before using this value to help to obtain the correct answer of 3.17 for $\mathrm{E}(X)$ in part (b)(i). Almost all candidates managed to calculate $\mathrm{E}(X^2) = \sum x^2 \times \mathrm{P}(X = x)$ in part (b)(ii), with very few wrongly thinking that this was the same as the variance. In part (c), although the majority of candidates used the most efficient ways of finding $\mathrm{E}(Y)$ and $\mathrm{SD}(Y)$, by evaluating $\mathrm{E}(Y) = 2 \times \mathrm{E}(X) - 3$ and $\mathrm{SD}(Y) = \sqrt{4 \times \mathrm{Var}(X)} = 2\sqrt{\mathrm{Var}(X)}$, there were frequent attempts made to tabulate the probability distribution for Y followed by the use of methods already employed in part (b). Although this process was often successful, it used up valuable time which could have been allocated to other more demanding parts of the paper.

Question 5

This question proved to be another good source of marks, with the majority of candidates gaining at least 7 marks. Part (a) was done by a variety of correct methods, with good conclusions in context often seen. Most candidates realised that a t-test was required, with only a few weaker candidates wrongly using $z = 2.3263$, instead of $t = 2.821$, as their critical value. In part (b), it was the population of times taken to complete the French assignment that must be assumed to be normally distributed and not, as was often quoted, the sample itself.

Question 6

In part (a), most candidates made a good attempt at sketching the graph of the probability function, although there were the usual weak attempts where candidates did not recognise that $\mathrm{f}(t) = \frac{3}{8}t^2$ is a quadratic curve whilst $\mathrm{f}(t) = \frac{1}{16}(t+5)$ is a straight line.

Part (b) was rarely attempted using the most efficient method of finding the area of a trapezium, but those candidates who did, usually did so correctly. The vast majority attempted to use integration when answering this part of the question, with either $\int_1^3 \frac{1}{16}(t+5)\,\mathrm{d}t$ or $1 - \int_0^1 \frac{3}{8}t^2\mathrm{d}t$ often being used correctly. However, integration was not necessary and its use here again used up valuable time which could have been helpful to some candidates elsewhere.

It was disappointing to see that only the most able students coped well with part (c)(i). Very few realised that $\mathrm{F}(t) = \mathrm{F}(1) + \int_1^t \mathrm{f}(t)\,\mathrm{d}t$ was required here, with the vast majority simply evaluating $\int_1^t \frac{1}{16}(t+5)\,\mathrm{d}t$ and then writing down the answer that was given in the question. Part (c)(ii) was tackled much better with many candidates obtaining the correct answer. The negative root to the obtained quadratic equation was correctly rejected but often without any justification being given.

Question 7

This type of question is always popular and this year it again proved to be a good source of marks. Most candidates correctly stated the null hypothesis and their conclusions were usually correctly stated in context. Many candidates used their calculator to perform all of the necessary working and simply stated their value for $\sum_i \left(\frac{(O_i - E_i)^2}{E_i}\right)$ and gave the critical value of $\chi^2 = 10.645$ before then stating their conclusion in context. This is a method to be encouraged, especially for those candidates who can use their calculators proficiently. It should be understood, however, that the wrong value stated for $\sum_i \left(\frac{(O_i - E_i)^2}{E_i} \right)$, together with no numerical calculations seen to indicate that a correct method has been used, will usually result in a loss of many marks. The responses to part (b) were rather mixed, with the correct answer "More of those students achieving level 7 at KS3 gained a grade A at GCE than was expected" often being seen. However, there were many general comments seen that did not relate to this group of students at all.

Coursework Component

General

There were a few transcription and addition errors made when totalling the scripts. The final marks should be carefully checked prior to submission to AQA and for moderation. Scripts should be marked in red pen and calculations checked for accuracy.

There were very few centres who submitted scripts this session. It is important that any centres tackling the Statistics 2 coursework ensure that they tackle a task which is on the current list of approved tasks. Centres should note that contingency tables are still on the specification but a chi-squared goodness of fit test on a distribution is no longer on the specification.

Mark Ranges and Award of Grades

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