GCE
MATHEMATICS

MS2B Statistics 2 Option B
Report on the Examination

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General

Students demonstrated a high level of competence in most of the various computational skills. However, understanding of what exactly is happening in a confidence interval or a hypothesis test was not always clearly demonstrated. Students should avoid the use of undefined "it" and "they" in explanations as it is not the responsibility of the examiner to guess to what these refer. Equally, abbreviated answers such as "Independent" or "H_0: No association" will not receive marks which a fuller answer may have earned. Nearly all students seemed to have had adequate time to attempt all the questions to the best of their abilities.

Question 1

The calculation part was well handled, apart from those students who used a z-value. A significant number performed a complicated calculation in part (b)(i), using the 2012 standard deviation and obtained the wrong answer. In part (b)(ii), a fair proportion of students recognised that the degree of overlap precluded any definite conclusion. Credit was given where students stated that there was some suggestion of a reduction in the mean, but others were often far too definite in their conclusions.

Question 2

Although the calculation of the test statistic was generally well done, with most students applying Yates' correction, very few truly appreciated what the χ^2-test showed. The hypotheses were often in terms of the phone call, and even where the hypotheses were in terms of 'method of contact' the final conclusion was often "showing that a phone call is more effective". Only the best students realised that the χ^2-test could only establish that an association between 'method of contact' and 'application for grant' existed, and that the values in the table must then be examined to support the council's belief. The majority correctly identified 'Type I error' and the reason for it.

Question 3

A reasonable proportion of students appreciated that a full explanation of why $a = 27$ required some mention of zero waiting time. Many wasted time with prolonged calculation of b, as they did in part (b), where formulae from the booklet could have been used. For those students who did use the variance formula, it was surprising how many wrote down the correct formula, but then in calculating the answer the square sign was lost or the $^1/_{12}$ became a ½. Whilst many students found part (c) straightforward, in addition to the expected incorrect use of a 10-minute interval, a one-sided interval of five or sometimes even three minutes, was frequently seen.

Question 4

Part (a)(i) was generally well answered and, in parts (ii) and (iii), the value of λ was usually correctly calculated, but the boundary values to be used caused more difficulty. In part (b), answers such as "The days are independent" or "The satellites are independent" showed why it could not be assumed that "They are independent" referred to the GRBs. A not uncommon answer was "Because mean and variance are equal" which showed that students were quoting learnt answers, without any regard for the information given, or not given, in the question.

Question 5

The majority of students scored very well on this question, although a few treated X as a continuous variable and performed various integrations and so scored few, if any, marks. Students should have appreciated that, in part (a)(iii), where they were required to 'Show that $\mathrm{Var}(X) = 1.5275$', simply quoting values such as $\mathrm{E}(X^2) = 7.05$ without any working, was not acceptable. This 'general principal' can be expected to apply on future papers. Part (b) was well done, although a small proportion of students, having found the variance, did not proceed to the standard deviation.

Question 6

The hypotheses were generally well expressed in terms of μ although often $\neq$ was used in H_1. Although the sign of the test statistic was usually correct, there was much confusion over the sign of the critical value. Sometimes a negative test statistic was compared with a positive critical value (often with a diagram showing that this was exactly what was being done). Frequently the critical value was stated as ± 1.6449 (sometimes with two-tailed diagrams) and from the two alternatives the negative was chosen because the test statistic was negative. The implication was that a test statistic of $+1.798$ would have been compared with $+1.6449$ and also resulted in the rejection of H_0 (as seemed to be the case where a modulus sign was used). The use of t_{19} rather than z was good in part (b). In part (c), most students appreciated the effect of the significance level in setting the probability of a Type I error.

Question 7

The sketch was reasonably well done and most students correctly showed the integration from 0 to x to find $\mathrm{F}(x)$. The calculation of the lower quartile was also well done. In part (c)(i), there was much fudging of the answer after the integral from 1 to x gave -4 while the required answer was -3, causing many to lose the mark for the correctly evaluated integral when they spuriously altered it. Often an incorrect answer to part (i) was carried over into part (ii) giving an incorrect equation, with the given $\mathrm{F}(x)$ been ignored. It was disconcerting to see how many students at this level could not even recognise or subsequently solve a quadratic equation. On the other hand, many students scored highly on all parts of this question.

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