A-LEVEL
FURTHER MATHEMATICS

7367/3S: Statistics
Report on the Examination

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General

This is the first session in which this paper has been taken. The paper appeared to offer ample opportunities for all students to score reasonable marks. On the other hand, there is still scope for solutions to some questions to improve. This was almost entirely due to difficulties in the interpretation of statistical results and concepts or not constructing fully rigorous arguments. In future students should work on ensuring that their mathematical arguments are complete and can be easily followed by other mathematicians. Care should also be taken when using statistical language to describe concepts or interpret results.

Question 1

The majority of students scored the mark for this question. The most common incorrect answers were 20 by multiplying the variance by 4 instead of 4 squared and 17 where 3 was subtracted after multiplying by 4.

Question 2

Many students scored the mark for this question but the majority did not. It was regrettable that an entirely precise calculation lands marginally closer to 18.8% than the 18.9% given as an option. Nevertheless, the far greater problem seemed to be that many students did not divide the variance by the sample size, resulting in 45.0% being the most frequently chosen answer.

Question 3

In part (a), the majority of students scored full marks for this part but many students scored zero. A common error was to use the wrong z-value, particularly 1.645. Some students used t-values instead and there was some evidence of errors caused by rounding intermediate steps.

The majority of students scored the mark in part (b). Some students did not refer to 30 in their answer and so did not make a clear comparison and could not be awarded the mark. Some students made an incorrect conclusion, in particular thinking that 30 was above 30.7.

The majority of students scored the mark in part (c). Many students stated that a t-distribution would need to be used but did not explain what it would replace. Some students made comments about the impact of the result, for example the width of the confidence interval, rather than the working. A minority of students stated that there would be no changes. Students who used the t-distribution in part (a) often commented that a different t-value would be needed in part (c). Some students stated that σ^2 would have to be replaced with s^2, which, whilst true, would not impact the working in this case.

Question 4

The majority of students scored at least four marks in part (a) but many students dropped the final mark for improper notation or not dealing with values of x outside the range from 0 to 6. Some students set up an incorrect equation for the mean or the variance and it was common to end up with two equations that were equivalent. Students who attempted to form their equations using first principles were more likely to make errors and never derive a correct equation.

Part (b)(i) expects a criticism of the model and this means addressing the issue of the suitability of the rectangular distribution. The best solutions suggested that the clothes line would be more likely to break at certain places – it didn't matter where these places were.

The majority of students did not score the mark in part (b)(ii), often omitting the reference to 6 in their sketch. Some students did not sketch a probability density function that was consistent with their criticism in (i) and thus were not awarded the mark.

Question 5

The majority of students scored full marks part (a) but many did not score the final mark for a correct solution with poor notation. Some students used an incorrect lower limit such as 0 or set their equation equal to 200 rather than 0.5.

The majority of students scored full marks for part (b). Some students incorrectly attempted to find $P(X > 2000)$ instead or integrated incorrectly.

The majority of students scored at least one mark for part (c). Most students did not attempt the part continuous, part discrete version which would have preserved the value of the median. Students that did often found it difficult to properly express their answer. Many students scored marks for $a = 2000$ or $k = 1/\ln 2000$ but a significant proportion gave one but not the other.

Question 6

The majority of students scored at least six marks for this part (a). Some students did not mention the variables in the hypotheses or put correlation instead of association. Some students made numerical slips when calculating the test statistic or used an incorrect formula, in particular not using Yates' correction. The vast majority of students compared their test statistic with a critical value, rather than calculating the corresponding probability on a calculator. Many students made a conclusion in context that was too definite in nature, stating that they had 'proved' or 'shown' rather than having found evidence 'suggesting' or 'supporting'. A minority of students produced a Poisson or binomial hypothesis test.

The vast majority of students did not score the mark in part (b), because they didn't identify that the key was Rebecca's assertion that it is 'easier' to pass at centre B. Many students agreed with Rebecca's claim and calculated proportions passing at each centre to justify their answer. Some students made the correct conclusion but only gave that the test was for association not which centre was easier, not dealing with Rebecca's interpretation of any association.

Question 7

The majority of students scored at least five marks for this part, but most did not include the correct assumption. Many students made a conclusion in context that was too definite in nature, stating that they had 'proved' or 'shown' rather than having found evidence 'suggesting' or 'supporting'. A common error was to use the population variance formula to calculate variance instead of the sample variance and some students used an incorrect formula for the sample variance. Other common errors include performing a z-test instead or using an incorrect critical value, often from choosing the wrong degrees of freedom.

Question 8

The vast majority of students scored the mark for in part (a)(i). The most common errors were calculation or rounding slips.

The majority of students scored full marks for in part (a)(ii). Some students identified the wrong probability, usually P($Y \geq 30$), and there was also some evidence of rounding errors.

The majority of students scored full marks in part (b) but many scored either one mark or no marks. Some students did not recognise the binomial model implied by the context and did not make any progress or only managed the correct combination of probabilities without the binomial coefficient.

The majority of students scored at least two marks for part (c)(i), with many scoring full marks. Students were seen using both the Poisson distribution approach and the exponential distribution approach. Some students using the exponential distribution incorrectly identified the mean as the parameter of the distribution. A common error was to calculate the wrong probability by not being consistent with the choice of distribution. Some students excessively rounded their final answer.

The majority of students scored at least one mark in part (c)(ii) usually for stating the same probability found in (c)(i). However, some students attempted to find the probability of none in 15 minutes instead, not recognising the memoryless property of the exponential distribution. Some students incorrectly stated that the Poisson distribution was memoryless, usually having used the distribution in (c)(i).

Use of statistics

Statistics used in this report may be taken from incomplete processing data. However, this data still gives a true account on how students have performed for each question.

Mark Ranges and Award of Grades

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