A-LEVEL MATHEMATICS

MS03 Statistics 03
Report on the Examination

6360
June 2016

Version: 1.0

Further copies of this Report are available from aqa.org.uk

Copyright © 2016 AQA and its licensors. All rights reserved.
AQA retains the copyright on all its publications. However, registered schools/colleges for AQA are permitted to copy material from this booklet for their own internal use, with the following important exception: AQA cannot give permission to schools/colleges to photocopy any material that is acknowledged to a third party even for internal use within the centre.

General

The overall performance by the small, but nevertheless welcome, increase in candidature was very much in line with that established in previous series. However, there was variation in the level of performance in certain topics this year as compared with previous years. In most questions, students showed sufficient method and working to support numerical answers and made appropriate use of their calculators' in-built functions and/or use of the supplied booklet of tables.

Question 1

This question proved a good source of early marks for most students. Almost all correctly recognised that the basis for part (a) was a binomial distribution, although a few, thankfully rare, based their methods on a Poisson or even a normal distribution. Some students used a pooling of the two proportions in estimating the variance; this is never correct in constructing confidence limits as it assumes equal population proportions! Surprisingly at this level, 1.6449, instead of 1.96, was sometimes used. Answers to part (b) revealed that most students recognised what was needed and so were able to carry out the comparison correctly.

Question 2

Overall performance on this regular question involving Bayes' Theorem was disappointing. Whilst all students scored the 3 marks in part (a), some tree diagrams were so 'messy' as to hinder the work in part (b). Few students multiplied out 'branch' probabilities and then checked that the 'end' probabilities totalled 1. This has been recommended as good practice in previous Examiner Reports and its absence almost certainly contributed to frequent downfalls in part (b). All too often, throughout part (b), incorrect numerical answers were only supported by complicated numerical expression that had no explanation. It is not part of an examiner's role to try to 'second guess' a student's approach in such circumstances. Similar problems arose in part (c) where, although it was often possible to identify $p_1^2 \times p_2^2$, the values were often incorrect and/or accompanied by 4 or $4!$ instead of 6.

Question 3

Unlike answers to Question 2, answers here were much improved on those for previous similar questions and more than 50% of students scored full marks. In many answers, pooling was attempted correctly, although there was no penalty for not pooling. Perhaps not surprisingly, the denominator of the z-statistic caused the most difficulty with $\sqrt{315+747}$ or $\sqrt{\frac{315}{30}+\frac{747}{60}}$ used with the numerator $(12.45-10.50)$.

Question 4

Again, many students scored well on this question. In part (a), they took due account of the given information, worked correctly with variances, not standard deviations, and took correct account of the correlation between V and W. Apart from a small number of numerical slips, the loss of a minimum of 4 marks here and 2 marks in part (b) was due to ignoring this correlation. Most students realised that part (b)(i) involved T and that part (b)(ii) involved $W - V$. Working as expected in minutes, they then scored well on the synoptic work in calculating normal probabilities.

Question 5

In part (a), there were very few fully correct answers. Most students ignored the phrase "assuming that H_0 is true" and so stated that $\mu_D = \mu_X - 1.5\mu_Y$. Many students also omitted the divisor *n* for the variance of $\bar{D}$ but a majority did obtain $3.25\sigma^2$. It was disappointing to see references here to binomial and Poisson distributions. In part (b), many students apparently failed to realise the connection with part (a) and this, together with the following list of frequent unexpected errors at this level, made marks hard to achieve.

- Hypotheses stated using $\bar{L}$ and $\overline{XL}$.
- Means re-calculated as $\frac{1509}{50}$ and $\frac{2261}{50}$ followed by $z = \frac{45.12 - 30.18}{\sqrt{\frac{4.5^2}{50} + \frac{4.5^2}{50}}}$.
- Critical value of *z* stated as 1.6449 instead of 1.96.

Question 6

Whilst most students were able to score at least 4 marks in part (a), the awarding of 7 marks was only attainable by those students who could produce correct and convincing, rather than somewhat fudged, proofs. Answers to part (b) generally showed a firm grasp of the use of a normal distribution as an approximation to a Poisson distribution including correct applications of continuity corrections. Most students also displayed the basic knowledge required in part (c). Here four different starting approaches could lead to the correct answer:

49 per 500 metres, 4.9 per 50 metres, 0.98 per 10 metres or 0.098 per metre.

Whilst at least one student achieved full marks using each approach, that with the highest success rate was 49 per 500 metres. Minimal, if any, marks were scored by those students either using 0.075 as the variance from part (b) or basing a solution on a binomial distribution.

Mark Ranges and Award of Grades

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

Converting Marks into UMS marks

Convert raw marks into Uniform Mark Scale (UMS) marks by using the link below.

UMS conversion calculator