Version 1.0

General Certificate of Education (A-level)
January 2013

Mathematics MS/SS1B

(Specification 6360)

Statistics 1B

Report on the Examination

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General

This final January series' paper proved to be more accessible than those of previous series. In the main this was due to the improved level of statistical knowledge and application demonstrated by the vast majority of students. However, the fact that early questions on the paper involved topics that had been handled well historically perhaps also played a smaller but nevertheless significant role. Thus Questions 1 to 4 proved to be a good source of marks for all but the weakest students, whereas Questions 5, 6 and particularly 7, proved to be successively more demanding.

Students of all abilities continued to be much more comfortable in answering quantitative requests than in attempting qualitative answers. Thus, when marks were lost by the stronger students, it was invariably due to an inability to demonstrate sufficient clarity in comments, explanations and conclusions. This was particularly evident in attempts at Question 7.

It was pleasing to note that most students used their calculator's in-built functions accurately when calculating sample means and standard deviations and correlation and regression coefficients. Having said this, some students gave the impression that they thought that their calculators automatically gave values for the mean and the **variance**. In other calculations, many students showed sufficient working to support their numerical answers, so that, when the latter were incorrect, some method marks could be awarded. Of particular note, was the use of diagrams in answering Question 2 on the normal distribution. These diagrams, together with the correct use of tables, often contributed to a high mark.

Question 1

Most students appeared well-prepared for this topic, but perhaps unknowingly, lost several marks through a lack of interpretation skills. Thus, 31, rather than 30, was a common answer to part (a), presumably as a result of the answer to part (b)(i) where 4 marks was the norm from use the of a calculator's in-built regression function. It should be noted that stated answers of the form 31 and -0.64, or $31 - 0.64x$ or $y = 31 - 0.64$ all lost marks. Interpretations in part (b)(ii), rarely scored 2 marks as they were usually restricted to 'negative correlation' (0 marks) or 'length decreases with time' (1 mark). Reference to the value of b was required for 2 marks, though in attempting this, some students lost a mark for introducing the double negative of 'decreases by -0.64'. Answers to part (b)(iii) were often correct, usually by showing that $y_{50} = -1$, or less often, by showing that when $y = 0$ then $x < 50$. Answers based on the point $(45, 2)$ scored no marks.

Question 2

The vast majority of answers here were of a very high standard, with 8 or 9 marks seen as the norm. It was also pleasing to see the absence of almost worthless attempts involving, for example, 'less than 110' implied 'less than or equal to 109 or 109.5' or the use of 2.5^2 or $\sqrt{2.5}$. When marks were lost, it was sometimes in part (b) for giving the answer to $\mathrm{P}(V < 100)$ or, more often, in part (d) for stating 0 or 0.5 or for attempting a somewhat complicated area evaluation.

Question 3

This was another well-answered question with full or almost full marks not unusual. Answers to parts (a)(i) and (iii) were almost always correct; part (i) using tables but part (iii) using the formulae. Students sometimes lost marks in part (a)(ii) through the use of $1 - 0.8849$ or by simply stating 0.8074 or 0.8849. Very few students lost marks in part (b) although some lost 2 marks by finding 'standard deviations' rather than 'variances'. In part (c)(i), this error was more common, perhaps due to simply writing down, without due thought, answers given by their calculators. These aforementioned errors in parts (b) and (c)(i) had an impact, often severe, on the marks available in part (c)(ii). The 3 marks available were for comparing each model's mean and variance with those found in part (c)(i) together with an overall conclusion. Even when based on fully-correct values, some statements made by students lacked sufficient clarity or were restricted to comparisons of means only.

Question 4

This was another good source of marks for many students although full marks were quite rare. Most students used their calculator's in-built function (as is now expected) to write down a correct answer, to at least three significant figures, in part (a)(i). In part (a)(ii), interpretations were too often spoilt by the use of 'very' though, thankfully, the use of 'little or no', 'small', 'poor', 'unlikely', etc were much less in evidence than in previous similar questions. The most common acceptable answers to part (b)(i) involved, by various phrases, 'checking for outliers' and 'checking for linear regression'. The popular 'checking answers' did not score a mark. It was surprising to see the number of students who lost a mark in part (b)(ii), either through an incorrectly plotted point (often G) or omitting labels. Answers to part (b)(iii) often suggested 'no correlation' or 'outliers present' though such statements were sometimes revised following answers to part (c) where most students were able to quote values within the generous ranges permitted and so scored 2 marks.

Question 5

This fairly standard probability question posed major difficulties to the weaker students whereas the stronger students scored high marks often with an apparent minimum of effort. Almost all students answered part (a)(i) correctly with slightly fewer scoring the mark in part (a)(ii) through the use of multiplication instead of addition. The use of conditional probability to answer parts (a)(iii) to (v) was beyond many students and it was not unusual to see repeated answers of 0.25 or 0.30. Of those students who scored very few marks in part (a), many were then able to make a sensible and often correct attempt at part (b). Whilst many students identified the need for $(0.30^2 + 0.25^2)$, this was sometimes spoilt by the introduction of 0.55, 0.55^{-1} or 2 as a multiplier.

Question 6

Full marks were not at all rare here but neither were low or zero marks. In part (a), those students who standardised using $0.15/\sqrt{12}$ scored at least 2 and often 4 marks. However, those who used 0.15 immediately scored no marks. Some students, presumably as a carry-over from June 2012, attempted, often with little or no success, an unnecessary change of units. In part (b)(i), a sensible substitution into $\bar{x} \pm z\frac{\sigma}{\sqrt{n}}$ was crucial to scoring marks. Whilst the majority of students did this very well, a significant minority used an incorrect z-value or omitted the divisor of $\sqrt{n}$. Correct deductions, usually following a correct confidence interval, were much in evidence in part (b)(ii). However stating that '4.5 was outside the interval' lost the 2 marks available. (Some students claimed that 4.5 was within $(4.57, 4.73)$).

Question 7

Whilst full marks were very occasionally seen to this question, scores of 4 or less were by far the most common. Most students had little or no idea as to how to answer this question. In answering part (a), common incorrect answers were 10, $\sqrt{10}$ (3.16), 20 or 100 whereas correct answers of 5 $(10/2)$ or preferably 3.33 $(10/3)$ were rarely seen. Some students scored 1 mark in part (b) for giving a reasonably clear argument as to why 391 was likely to be incorrect. However, even when part (a) was answered correctly, a valid reason as to why 95.5 was likely to be incorrect proved a step too far for most students. In part (c), most students scored 1 mark for $8210/10 = 821$ or for $10 \times 820 = 8200$. A straight comparison of 821 with 820 scored a second mark, but those students who found 8200 were required to indicate that 8210 was within 100, not 10, for this second mark. It was very disappointing in part (c) to see those of students who failed to realise that it was necessary to calculate $\sqrt{\frac{110}{9}}$ or $\sqrt{\frac{110}{10}}$ in order to comment on the value of $\sum(y-\bar{y})^2$, particularly given the formula for s^2 in the booklet. All too often, they argued that $\sqrt{110} \approx 10$ which, in turn, approximately equalled their (incorrect) value of σ in part (a).

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the Results Statistics page of the AQA Website: http://www.aqa.org.uk/over/stat.html

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

UMS conversion calculator www.aqa.org.uk/umsconversion