GCE
MATHEMATICS/STATISTICS

MS1B/SS1B Statistics 1 Option B
Report on the Examination

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General

The distribution of marks, in terms of average and spread, was close to that expected and in line with the general level seen on many previous June papers. However, whilst there appeared plenty of accessible marks for weaker students, the stronger students often found it difficult, but not impossible, to score close to full marks.

In general, students were well-prepared for the topics examined and so it was rare indeed to see a student making no attempt at a question or attempting to answer a question using an incorrect statistical technique.

The majority of students made good use of their calculators and the supplied booklet to provide numerical answers to an acceptable level of accuracy. However, a significant number of students appeared unaware of Table 4 or of the formulae for correlation and regression on Page 13. In both cases such students usually lost significant numbers of marks. As mentioned in previous Examiners Reports, those students who used their calculators' in-built statistical functions to quote answers to binomial, normal and estimation questions without any evidence of working lost all the marks available for incorrect answers. Not surprisingly, students remained much more competent in answering numerical, rather than discursive, questions.

One very disturbing aspect seen far too frequently was the carelessness in reading questions (misreads), copy errors in solutions (miscopies) and what can only be described as poor levels of simple numerical manipulation. In many cases, such errors cost students at least one classification grade. Typical frequent examples of these errors were:

- the evaluation of $\frac{5}{9}(f-32)$ as $\frac{5}{9}f-32$ (Question 1);
- an inability to solve $\frac{x-421}{2.5}=2.0537$ for x and/or using 0.3 instead of 3.0 (Question 2);
- an inability to evaluate a correctly-expressed binomial probability (Question 3);
- an inability to evaluate $\frac{a}{\sqrt{b\times c}}$ and/or $69.3\times 1.25^2\times 1.15$ (Question 4);
- the evaluation of 0.95×0 as 0.95 (Question 5);
- the evaluation of $\frac{0.4}{\sqrt{25}}$ as 0.8 and/or $19.9\pm 2.3263\times\frac{0.4}{\sqrt{25}}$ as $(19.9\pm 2.3263)\times\frac{0.4}{\sqrt{25}}$, and/or using 3.5 instead of 0.35 (Question 6).

Reading information correctly and then analysing it accurately are important skills in statistics so students were expected to be more careful and have a working knowledge of simple numerical manipulation in order to achieve grades that truly reflected their statistical abilities.

Question 1

Most students scored the 2 marks in part (a)(i) and the 1 mark for the mean in part (a)(ii). However, a minority considered the *u*-values as frequencies for the corresponding *v*-values and so scored no marks at all in part (a)(i). Very few students found the correct value for the standard deviation in part (a)(ii) as they used $s_{\mathrm{C}} = \frac{5}{9}\left(s_{\mathrm{F}} - 32\right)$ instead of $s_{\mathrm{C}} = \frac{5}{9}s_{\mathrm{F}}$. The fact that the answer was negative was rarely a matter for concern as most students subsequently simply omitted the negative sign. Part (b) was not always attempted but, where a value for r_{xy} was stated, it was usually correct. Small numbers of students used $r_{xy} = \frac{5}{9}\left(r_{uv} - 32\right)$ for no marks whilst a similar number ignored the word 'state' but used the given equation to change all the original values from °F to °C before calculating r_{xy} but rarely with sufficient accuracy. Only a minority of students were able to explain that r was unaffected by a change of units with the majority giving a vague description of relative values being unchanged or the same formula applied to both *u* and *v* but with no reference to linear change.

Question 2

This question provided almost a full spread of marks. In part (a)(i), more students than in previous papers standardised 421 leading to $\mathrm{P}(Z = 0)$ so giving a probability of 0.5 whilst others found $\mathrm{P}\left(420 < X < 421\right)$. Answers that stated the word "impossible" only were not accepted. Answers to part (a)(ii), in which standardisation gave a positive z-value, were generally correct although a minority of students changed 425 to 424 and so lost both marks. Given that a very similar question to part (a)(iii) appeared on a recent paper, it was disappointing to see the number of incorrect answers. Most students attempted two separate standardisations rather than apply symmetry with many unable to complete the former successfully. Whilst there were fully correct answers to parts (b) & (c), there were far too many answers that scored only 1 mark for both. In the main, the loss of marks was due to students not using Table 4 in the supplied booklet but simply equating $\frac{x - 421}{2.5}$ to 0.98 and $\frac{410 - \mu}{3.0}$ to 0.01 or 0.50399. Those students who, in part (c), used +2.3263, instead of –2.3263, and so obtained an answer of $\mu = 403$ scored 3 of the 4 marks.

Question 3

Almost all students scored the mark in part (a)(i) with slightly fewer scoring the 2 marks in part (a)(ii) where only 1 mark was available for $1 - 0.9597$. It was quite rare to see an incorrect answer to part (a)(iii) where an evaluation of a binomial term was required. A small minority failed to evaluate the correct expression correctly (loss of 1 mark) or attempted to use Table 1 and averaging values for 0.15 and 0.20 (loss of both marks). In part (a)(iv), despite the example given in the question, about 50% of students scored no marks due to not finding the correct value of 0.35 for p. The common error was $p = 0.85 \times 0.5 = 0.425$ followed by interpolation from Table 1 or use of a calculator's in-built function. Some students even tried to evaluate the probability for $p = 0.85$ and $p = 0.85$ separately and then subtract the two resulting probabilities. Similarly, in part (b), many students failed to find the correct value of p with 0.85×0.175 as a common incorrect attempt. A minority of students scored 1 mark for 0.325 or 13.

Question 4

A large majority of students scored the 3 marks in part (a) but this was not the case for those who had apparently no idea that the necessary formula was given on Page 13 of the supplied booklet. Following correct answers in part (a), almost all such students correctly described $r = 0.911$ as indicating "strong positive correlation" but most did not describe
$r = 0.641$ as "moderate positive correlation" with "moderately strong correlation" being a very common incorrect description here. Some students compared the relative strengths of the two values and so generally only scored 1 of the 3 marks available. Following from correct work in part (a), most such students calculated the correct value for r_{xy} in part (c)(i) and then correctly stated "x". Answers to part (c)(ii) were, as expected, rarely incorrect. Whilst many students were successful in finding the equation of the least squares regression line in part (c)(iii), it appeared that some students were totally unaware of the approach required. Thus common approaches were $a = 116 - 115.4b$ without any prior attempt to find b or, if b was attempted, it was often calculated from $\frac{116}{115.4}$. It was very rare to see 4 marks scored in part (c)(iv) with 1 or 2 marks by far the most common. This was invariably due to students ignoring the guidance given in the question. Students were required to:

- explain that $r_{xy} = 0.982$ indicated "very strong correlation" ("strong" or "high" were not accepted);
- comment on the fact that $b \approx 1$;
- comment on the fact that $a \approx 0$ ("small" was not accepted);
- state that, as a result, the estimate (not "it") was likely to be (very) accurate ("quite" or "fairly" were not accepted).

Question 5

Answers to this question on probability were, in the main, of a high standard and showed a marked improvement on similar questions in previous papers. It was quite rare to see an incorrect answer to part (a) with $0.90 + 0.95 - 0.855$ in (ii) being by far the most common error. Most students also scored well in part (b) with few students not scoring full marks in (i) to (iii). However, (iv) proved more challenging with $0.10 \times 0.15 + 0.05 \times 0$ as a frequent incorrect answer. Even some better students lost 1 mark due to calculating $0.085 + 0.05$ instead of 0.085×0.05.

Question 6

Most students found the confidence interval correctly. Occasional errors, in addition to simple numerical ones, were the use of $\sum x$ rather than $\bar{x}$, an incorrect z-value or the omission of $\sqrt{25}$. Despite similar requests appearing on many previous papers, students often did not make an explicit comparison of the stated 20 kg claim with their confidence interval. The use of "it" or "mean" was not accepted nor, of course, was a comparison of 20 kg with $\bar{x}$. In part (a)(iii), all too often, one of the words "it", "mean", "data", "sand" or "bags" was used and so the answer scored no marks. Also, reference to sample size was not relevant nor was the claim that "... because my teacher said that it would not be needed." Again, despite similar questions appearing on previous papers, many students remained unable to distinguish between the two structures in part (b). Thus standardising using $\frac{0.35}{\sqrt{10}}$ in both parts was common as was the failure to raise a probability to the power 10 in part (b)(ii). Nevertheless, a significant proportion of students, not all of whom were necessarily high achievers, scored full marks in part (b).

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 www.aqa.org.uk/umsconversion