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Mathematics MS/SS1B

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Statistics 1B

Report on the Examination

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General

The vast majority of candidates were able to make at least worthwhile attempts at the first five questions, with even average candidates able to score many of the 50 available marks. However, questions 6 and 7 proved much more of a challenge, with even above average candidates often scoring few of the 25 available marks. As a result, there was only a small proportion of very weak scripts (< 25 marks) but also a similar proportion of very strong scripts (> 65 marks).

In general, candidates showed sufficient working to allow some method marks to be awarded for incorrect numerical answers and, at the same time, usually made appropriate use of their calculators and the supplied blue AQA booklet of formulae and statistical tables. Candidates from a small number of centres used a dangerous strategy of simply quoting normal and binomial probabilities; some such candidates paid a heavy price.

As has been the case on previous papers, candidates made much better attempts at numerical work than at parts that required discursive answers. This weakness was particularly noticeable in questions 5 and 7. In particular, future candidates should be advised that 'it' is rarely, if ever, an acceptable descriptor when making a comment or interpretation.

Question 1

Most candidates got off to a confident start here, with very few not scoring all 3 marks in part (a). Answers to part (b) were generally sufficient but some statements lacked clarity whilst others suggested alternative grouping, recording the maximum and minimum values or even turning the data into some graphical presentation.

Question 2

This question, as expected, proved a source of 3 marks for the vast majority of candidates. No part proved more difficult than the others and it was rare indeed to see a loss of more than 1 mark. Some candidates wasted valuable time by writing, for each part, a full description in support of their answer. This was unnecessary since 'state', without any reference to 'reason', implied that each answer simply required only two words.

Question 3

Most candidates scored well on this question involving normal distributions, with full marks often achieved in part (a). However, weaker candidates lost 2 marks in part (a)(ii) for calculating $\mathrm{P}(X < 25)$ as 0.242. Most such candidates then lost a further 2 marks in part (a)(iii) by evaluating [(i) – (ii)] since, whilst this gave the correct answer of 0.546, it was the result of two errors. All but the weakest candidates were able to make a good, often fully correct attempt at part (b), usually by working with $\dfrac{\frac{65}{1.34} - 32}{10}$. Some lost an accuracy mark for rounding $\dfrac{65}{1.34}$ to 48 or 49, whilst others lost 2 marks for evaluating $\mathrm{P}(\mathrm{bill} < 65)$. A minority of candidates attempted to work with the distribution of the bill and, whilst they had the correct mean of 42.88, they left the standard deviation as 10. Answers to part (c) were poor and rarely scored the 2 marks available. It was expected, from the wording of the question, that candidates would recognise the possibility of other types of customer, fuel and/or vehicle. However, most candidates either concentrated on the actual distribution of X or commented on the variation in unleaded petrol sales due to factors already accounted for by the distribution $\mathrm{N}(32, 10^2)$.

Question 4

This question proved a good source of marks for almost all candidates; clearly they had a very sound grasp of the applications of binomial distributions. By far the most common approach in part (a) was to use the formula in part (a)(i) and then tables in parts (a)(ii) and (a)(iii). In part (a)(iii), the usual confusions sometimes arose as to whether to use the values for $x = 9$ or 10 or for $x = 4$, 5 or 6. In part (b), the only noticeable error was to evaluate $(32 \times 0.15 \times 0.85)$ as 4.08 but then not take the square root; a loss of 1 mark here. Almost all candidates calculated correctly, using their calculators' mean and standard deviation functions, the mean and the standard deviation of the given 13 values. Many then went on to compare the 2 mean values and the 2 standard deviation values and so comment on the proposed model's suitability. Centres are advised that comments of the form 'means and standard deviations are different' is not sufficiently clear for the awarding of marks.

Question 5

This question on regression was a good source of marks for most candidates. Most candidates failed to score the 1 mark in part (a) often through use of the word 'it'. They almost invariably scored all 5 marks in part (b), through accurate use of their calculators' regression functions. However, candidates should be advised not to round their values of a and b to less than three significant figures in their equations since subsequent use of the latter will lead to inaccuracies in calculations. Also, equations should include '$y =$' and '$+ -0.0758$' should be written as '-0.0758'. Interpretations in part (c) were somewhat less impressive. Whilst most candidates identified $a = 5.35$ as the calorific value for dry wood or wood with 0% moisture, many fewer could interpret fully the value of $b = -0.758$. The usual partially correct interpretations were 'negative correlation' or 'as moisture increases, calorific value decreases'. Answers to part (d) were usually correct but the same cannot be said in relation to part (e). Many candidates gave an answer of $+0.2$ instead of -0.2, a loss of 1 mark, whilst others attempted to find a value of x or even the PMCC, r. The majority of candidates indicated 'accurate' in part (f) but some answers stated 'likely' and/or involved very strange reasoning. Whilst a minority of candidates confused the two requests in part (g), most candidates recognised what was required. Thus in part (g)(i), most stated the equivalent of 'extrapolation' or 'outside observed range'. However, in part (g)(ii), far too many candidates simply stated that the value of y might/would be negative which would be impossible. A correct answer required the evaluation of y_{80} followed by a statement indicating that a negative calorific value (not y) would be impossible.

Question 6

This probability question unexpectedly proved a major or even unachievable challenge to many candidates since they appeared to have no real grasp of a scenario involving two non-mutually exclusive events but instead considered them to be independent events. As a result, common worthless answers to part (a) were: $0.15 \times 0.40 = 0.06 \approx 0.10$; $(0.85 \times 0.40) + (0.15 \times 0.60) + 0.55 = 0.98$; $(0.85 \times 0.40) + (0.15 \times 0.60) = 0.43$. Centres are reminded that the addition law for two non-mutually exclusive events is part of the specification. Those better prepared candidates, who were able to construct a correct 2×2 table, draw a correct Venn diagram or use the correct addition law formula, scored at least 2 and quite often all 5 marks. Those candidates using the addition law formula in part (a)(i) sometimes fudged their answer and rarely supplied sufficient detail for the awarding of the full 3 marks. Those candidates scoring few, if any, marks in part (a) faired a little better in part (b) since they were often able to score the 2 marks in part (b)(i) and then one further mark in part (b)(ii) for 0.55×0.70. This expression was often accompanied by several incorrect expressions each the product of three probabilities (independence again). The best candidates who scored full or nearly full marks in part (a) usually followed this by a similar impressive performance in part (b), where some very succinct and elegant solutions were seen to part (b)(ii).

Question 7

Most candidates found much of this question very challenging. In part (a)(i), it was most disappointing to see the number of candidates failing to score 3 marks. Whilst there was some excuse for candidates dividing $\sum\left(x-\overline{x}\right)^2$ by 50, rather than 49, there was really no excuse for the many who did not know that $\overline{x}=\frac{\sum x}{50}$. Frequent incorrect attempts included trying to substitute $\sum x$ into $\sum\left(x-\overline{x}\right)^2$ or dividing $\sum x$ by a variety of denominators. Some candidates were confused, either at the outset or later, by the units involved with invalid multiplications of s^2 by 1000 taking place at some point. In part (a)(ii), the common incorrect answers were verbose about university salaries or simply that 24.0 was too large when compared to 45.8. Even those candidates who calculated, for example $(45.8 - 2 \times 24.0)$, simply stated that a normal distribution or 'it', instead of salaries, could not take negative values. Answers to part (b)(i) were slightly better with candidates indicating a 'large sample' so 'Central Limit Theorem applied'. Some candidates lost both marks for 'if sample is large' whilst others lost a mark for suggesting that other than the sample mean could be assumed to be normally distributed. There were many partially correct answers to part (b)(ii) using follow-through answers from part (a)(i) though some candidates lost further marks for an incorrect z-value. In answering part (c), a majority of candidates attempted the comparison of 55 with their CI or UCL. However, far too many then did the same with 60 rather than compare $\frac{6}{50}=12\%$ with 25%, or considered the standardising of 60 using a normal distribution. This perhaps suggested that they had not read the question with sufficient care.

Mark Ranges and Award of Grades

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