Mark Scheme (Results)

January 2020

Pearson Edexcel Award
In Statistical Methods (AST30)
Paper 1

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NOTES ON MARKING PRINCIPLES

1 Types of mark

M marks: method marks
A marks: accuracy marks
B marks: unconditional accuracy marks (independent of M marks)

2 Abbreviations

cao – correct answer only
isw – ignore subsequent working
oe – or equivalent (and appropriate)
indep – independent
ft – follow through
SC: special case
dep – dependent

3 No working

If no working is shown then correct answers normally score full marks
If no working is shown then incorrect (even though nearly correct) answers score no marks.

4 With working

If there is a wrong answer indicated on the answer line always check the working in the body of the script (and on any diagrams), and award any marks appropriate from the mark scheme.
If working is crossed out and still legible, then it should be given any appropriate marks, as long as it has not been replaced by alternative work.
If it is clear from the working that the "correct" answer has been obtained from incorrect working, award 0 marks. Send the response to review, and discuss each of these situations with your Team Leader.
If there is no answer on the answer line then check the working for an obvious answer.
Any case of suspected misread loses A (and B) marks on that part, but can gain the M marks. Discuss each of these situations with your Team Leader.
If there is a choice of methods shown, then no marks should be awarded, unless the answer on the answer line makes clear the method that has been used.

5 Follow through marks

Follow through marks which involve a single stage calculation can be awarded without working since you can check the answer yourself, but if ambiguous do not award.

Follow through marks which involve more than one stage of calculation can only be awarded on sight of the relevant working, even if it appears obvious that there is only one way you could get the answer given.

6 Ignoring subsequent work

It is appropriate to ignore subsequent work when the additional work does not change the answer in a way that is inappropriate for the question: e.g. incorrect cancelling of a fraction that would otherwise be correct

It is not appropriate to ignore subsequent work when the additional work essentially makes the answer incorrect e.g. algebra.

Transcription errors occur when candidates present a correct answer in working, and write it incorrectly on the answer line; mark the correct answer.

7 Parts of questions

Unless allowed by the mark scheme, the marks allocated to one part of the question CANNOT be awarded in another.

8 Use of ranges for answers

If an answer is within a range this is inclusive, unless otherwise stated.

9 Probability

Probability answers must be given as fractions, percentages or decimals. If a candidate gives a decimal equivalent to a probability, this should be written to at least 2 decimal places (unless tenths).

Incorrect notation should lose the accuracy marks, but be awarded any implied method marks.

If a probability answer is given on the answer line using both incorrect and correct notation, award the marks.

If a probability fraction is given then cancelled incorrectly, ignore the incorrectly cancelled answer.

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Question	Working	Answer	Mark	Notes
1 (a)(i)		Correct advantage	1	B1 for correct advantage, e.g., quicker, cheaper, less data to handle, easier
(ii)		**List** of **all** cars caught speeding (along this road)	1	B1 for list/register/database of all cars/drivers caught speeding (along this road) oe
(b)		Correct disadvantage	1	B1 for accuracy not known/not reliable, may be out of date oe
(c)		$\frac{23}{50}$	2	M1 for $\frac{11+9+3}{50}$ A1 for $\frac{23}{50}$ oe
2 (a)	<table><tr><td></td><td>4</td><td>355678</td></tr><tr><td>985</td><td>5</td><td>01125</td></tr><tr><td>87763</td><td>6</td><td>2489</td></tr><tr><td>9632</td><td>7</td><td></td></tr><tr><td>665</td><td>8</td><td></td></tr></table> 3|6|2 represents winter 63 minutes and summer 62 minutes	Correct back-to-back stem and leaf diagram	4	B3 for correct leaves for both (B2 for correct leaves for either winter or summer) (B1 for correct diagram with at most 2 errors in leaves) B1 for correct keys
(b)	<table><tr><td></td><td>Win</td><td>Sum</td></tr><tr><td>Med/mean</td><td>68/71</td><td>51/53</td></tr><tr><td>Mode</td><td>67 and 86</td><td>45 and 51</td></tr><tr><td>IQR/range</td><td>16/31</td><td>16/26</td></tr><tr><td>Skew</td><td>positive</td><td>positive</td></tr></table>	Correct comparisons	2	B2 ft for two comparisons from 1. Comparison of median/mean/mode. 2. Comparison of IQR/Range. 3. Comparison of skew.

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Question	Working	Answer	Mark	Notes
3 (a)	Appendix 1	3 and 8 14, 21 and 10 4	3	B1 for 3 and 8 B1 for 14, 21 and 10 B1 for 4
(b)		*W* and *B*	1	B1 for *W* and *B* oe
(c)		$\frac{4}{60}$	1	B1 for $\frac{'4'}{60}$ oe provided it is a probability
(d)		$\frac{11}{32}$	2	M1 for $\frac{'3'+'8'}{32}$ A1 for $\frac{11}{32}$ oe
4 (a)		Correct probability tree diagram	2	B1 for correct probabilities on the first branches (0.75, 0.25) B1 for correct probabilities on the second branches (0.9, 0.1)
(b)		0.3	3	M1 for ('0.75' × '0.1') or ('0.25' × '0.9') oe M1 for ('0.75' × '0.1') + ('0.25' × '0.9') oe A1 for 0.3 oe
5 (a)		Correct method	3	M1 for (IQR =) 540 – 470 (= 70) seen M1 for using UQ + (1.5 × 'IQR') A1 700 > 645 oe
(b)		Correct box plot	3	M1 for box plot with any one value correct A1 for 3 or 4 correct values A1 for all 5 with outlier correctly shown
(c)	<table><tr><td></td><td>Med</td><td>IQR</td><td>Range</td><td>Skew</td></tr><tr><td>G</td><td>545</td><td>100</td><td>195</td><td>sym</td></tr><tr><td>B</td><td>510</td><td>70</td><td>270</td><td>neg</td></tr></table>	Two correct comparisons	2	B2 for any two comparisons from 1. Comparison of median. 2. Comparison of IQR/Range. 3. Comparison of skew. 4. Govind has no outliers and Ben does

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Question		**Working**	**Answer**	**Mark**	**Notes**
6			105	2	M1 for 0.35 × 300 oe A1 for 105
7	(a)	0.9, 4.6, 4.2, 1.6	Correct histogram	4	M1 implied by one correct frequency density A2 for four blocks with correct widths and correct heights (A1 for 2 or 3 correct blocks) B1 for correct vertical scale with label or key
	(b)	$\sum fx$ = (10×18) + (25×46) + (37.5×63) + (47.5×8) = 180+1150+2362.5+380 = 4072.5 $^{4072.5}/_{135}$ = 30.2	30.2	3	M1 for $\sum fx$ using midpoints (condone one error) (= 4072.5) dep M1 for '4072.5' ÷ 135 A1 for awrt 30.2
	(c)		10.31	2	M1 for $\frac{137193.75}{135} - (\text{'}30.2\text{'})^2$ A1 for 10.2 – 10.31
8	(a)		129	2	M1 for 40 : n = 14 : 45 (may be implied by 128…) A1 for 129 accept 128 or 130 with working
	(b)		Correct assumption	1	B1 for correct assumption, e.g., no change in population or random selection (of squirrels) or tags have not come off oe
9			8	2	M1 for $\frac{27}{150} \times 45$ (may be implied by 8.1) A1 for 8

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Question	**Working**	**Answer**	**Mark**	**Notes**
10 (a)		97.6	2	M1 for $\frac{17145}{17575} \times 100$ A1 for awrt 97.6
(b)		98.2	2	M1 for $\sqrt[4]{97.3 \times 99.1 \times 98.8 \times' 97.6'}$ A1 for awrt 98.2
(c)		(Over the four months) the average selling price of the cars fell by 1.8% on average each month.	2	B1 for '1.8%' B1 for 'decrease on average each month'
11 (a)		1.75	2	M1 for $\frac{\pm(57-50)}{4}$ A1 for 1.75
(b)		44	2	M1 for $-1.5 = \frac{\pm(x-50)}{4}$ A1 for 44
(c)		Mark and correct reason	1	B1 for Mark because his standardised score was lower Allow Mark because he was 4 minutes faster oe

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Question	**Working**	**Answer**	**Mark**	**Notes**
12 (a)		0.82	3	M1 for finding $\sum d^2$. Finding d^2 for at least 5 pairs and adding together (may be implied by 30) M1 for r_s=1− $\frac{6\times'30'}{10(10^2-1)}$ A1 for awrt 0.82
(b)(i)		Positive correlation	1	B1 for positive correlation ft provided −1 ≤ part (a) ≤ 1
(ii)		As the weight increases the blood pressure increases.	1	B1 for as the weight increases the blood pressure increases oe ft provided −1 ≤ part (a) ≤ 1
13 (a)		0.107	2	M1 for $(1-0.2)^{10}$ A1 for awrt 0.107
(b)		0.376	2	M1 for part (a) + $10 \times 0.2 \times (1-0.2)^9$ A1 for 0.375 - 0.376
14 (a)		−718.2	1	B1 for −718.2 or −718
(b)		−0.87	3	M1 for $\frac{'-718.2'}{\sqrt{1021.6\times660}}$ M1 for $\frac{-718.2}{\sqrt{1021.6\times660}}$ or $\frac{-718}{\sqrt{1021.6\times660}}$ A1 for awrt –0.87
(c)		Correct interpretation	1	B1 e.g. As the volume increases the pressure decreases oe ft provided −1 ≤ part (b) ≤ 1

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Question	**Working**	**Answer**	**Mark**	**Notes**
15 (a)		A correct normal distribution curve	3	M1 for a bell shaped curve A1 for symmetry about the mean 35 **or** for the curve starting at 32 and ending at 38 A1 for a correct normal distribution curve where Himley is taller than Penn
(b)		Two correct comparisons	2	B1 for comparison of average, for e.g., Mean/mode/median of Penn Airport is less than the mean/mode/median of Himley airport B1 for comparison of spread, for e.g., Range/standard deviation of Himley Airport is less than the range/standard deviation of Penn Airport
16 (a)(i)		0.65	1	B1 for 0.65 oe
(ii)		0.08	1	B1 for 0.08 oe
(b)		0.56	3	M1 for 0.8 × 0.35 or 0.28 seen M1 for '0.28'/0.5 A1 for 0.56 oe
17 (a)		Upwards	1	B1 for upwards oe
(b)		46.67	2	M1 for $\frac{(280-220)+(330-280)+(370-340)}{3}$ or $\frac{60+50+30}{3}$ A1 for 46 - 47

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Question	**Working**	**Answer**	**Mark**	**Notes**
18 (a)		0.9332	2	M1 for $\pm\left(\frac{5180-5000}{120}\right)$ or ± 1.5 A1 for 0.9332 cao
(b)		0.0401	3	M1 for $\pm\left(\frac{5210-5000}{120}\right)$ or ± 1.75 M1 for 1 – '0.9599' A1 for 0.0401 cao

Appendix 1