Mark Scheme (Results)

Summer 2015

Pearson Edexcel Level 3 Award
in Statistical Methods (AST30)

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NOTES ON MARKING PRINCIPLES

1 All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.

2 Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.

3 All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.

4 Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.

5 Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

6 Mark schemes will indicate within the table where QWC is being assessed. The strands are as follows:

i) *ensure that text is legible and that spelling, punctuation and grammar are accurate so that meaning is clear*
  Comprehension and meaning is clear by using correct notation and labeling conventions.

ii*) select and use a form and style of writing appropriate to purpose and to complex subject matter*
  Reasoning, explanation or argument is correct and appropriately structured to convey mathematical reasoning.

iii) *organise information clearly and coherently, using specialist vocabulary when appropriate*.
  The mathematical methods and processes used are coherently and clearly organised and the appropriate mathematical vocabulary used.

7   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If working is crossed out and still legible, then it should be given any appropriate marks, as long as it has not been replaced by alternative work.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.

8   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.

Guidance on the use of codes within this mark scheme

M1 – method mark
A1 – accuracy mark
B1 – Working mark
C1 – communication mark
QWC – quality of written communication
oe – or equivalent
cao – correct answer only
cso – correct solution only
ft – follow through
sc – special case
dep – dependent (on a previous mark or conclusion)
indep – independent
isw – ignore subsequent working
awrt – answer which rounds to

Question		Working	Answer	Mark	Notes
1	(a)(i)		discrete	2	B1 for discrete accept quantitative
	(ii)		correct advantage		B1 for eg You know how it is obtained Accuracy is known/more reliable
	(b)	$\sum fx$=(1x3)+(2x6)+(3x8)+(4x10)+(5x3) =3+12+24+40+15=94 $^{94}/_{30}$ = 3.13	3.13	2	M1 for $\frac{'94'}{30}$ A1 for awrt 3.13
	(c)	$\sum fx^2$ =(1^2x3) + (2^2x6) + ... = 334 $\frac{334}{30} - \left(\frac{94}{30}\right)^2$ 1.15	1.15	2	M1 for $\frac{'334'}{30} - \left(\frac{'94'}{30}\right)^2$ (=1.3155..) A1 for awrt 1.15
2	(a)	99 | 1 | 875421 | 2 | 478 9864 | 3 | 6899 421 | 4 | 25789 | 5 | 145 Key: 9|1 means 19 (kg) for Untreated 2|4 means 24 (kg) for Treated	Stem & leaf and two keys	4	B3 for correct leaves for both (B2 for correct leaves for either Untreated or Treated) (B1 for correct diagram with at most 2 errors in leaves) B1 for correct keys
	(b)		2 correct comparisons	2	B2 for two comparisons from 1. Comparison of median/mean. 2. Comparison of IQR/Range. 3. Comparison of skew.

Table for 2(b):

	Med	Mean	IQR	Range	Skew
Untreated	28	30.6	17	25	Positive
Treated	42	41.5	13	31	Negative

Question		Working	Answer	Mark	Notes
3	(a)		13	2	M1 for $^{41}/_{200}$ x 65(=13.3125) oe A1 for 13
	(b)		$\dfrac{62}{791}$	2	M1 for $\dfrac{32}{113} \times \dfrac{31}{112}$ oe $\dfrac{m}{n} \times \dfrac{m-1}{n-1}$ only A1 for $\dfrac{62}{791}$ oe
4	(a)		Complete probability tree diagram	2	B1 for correct probabilities on Anjali's branches (0.15, 0.85) B1 for correct probabilities on Kate's branches (0.2, 0.8)
	(b)		0.03	2	M1 for '0.15' × '0.2' A1 0.03 oe
	(c)		0.29	3	M1 for ('0.15' × '0.8') **OR** ('0.85' × '0.2') oe M1 for ('0.15' × '0.8') + ('0.85' × '0.2') oe A1 for 0.29 oe

Paper: AST30_01					
Question		**Working**	**Answer**	**Mark**	**Notes**
5	(a)	See Appendix 1	14 17,22,11 29,33,42 32	4	B1 for 14 B1 for 17,22,11 B1 for 29,33,42 B1 for 32
	(b)(i)		$\dfrac{32}{200}$	3	B1 for $^{'32'}/_{200}$ or oe
	(ii)		$\dfrac{50}{200}$		M1 for $\dfrac{'22'+'17'+'11'}{200}$ A1 for $\dfrac{50}{200}$ or oe ft provided numerator is less than 200
6			Histogram	4	B1 for suitable vertical scale labelled frequency density oe or suitable key M1 for calculating frequency density ratios, eg $^{42}/_{20}$, $^{156}/_{40}$, $^{84}/_{60}$, $^{64}/_{80}$ A2 for four blocks with correct widths and correct heights (A1 for 3 correct)

Question		Working	Answer	Mark	Notes
7	(a)		112.1, 114.7, 131.6	3	M1 for $\frac{1020}{910} \times 100$ **or** $\frac{1170}{1020} \times 100$ **or** $\frac{1540}{1170} \times 100$ A2 for 112.1, 114.7, 131.6 (A1 for 112.1 or 114.7 or 131.6)
	(b)		119.2	2	M1 for $\sqrt[3]{'112.1' \times '114.7' \times '131.6'}$ A1 for awrt 119.2
	(c)		19.2% annual increase	2	B1 for '19.2'% increase oe B1 for (average) annual increase oe 2 marks for 'annual increase of 19.2%'
8			350 + correct assumption	3	M1 for $^{70}/_n = {}^{12}/_{60}$ oe A1 for 350 B1 for correct assumption, e.g., n constant or random selection (of birds) or tag not broken
9	(a)		Downwards	1	B1 for downward oe
	(b)	[(9 - 9.8)+(7 - 8.2)+(5 -6.6)]/3 = [(-0.8)+(-1.2)+(-1.6)]/3 = -1.2	-1200	2	M1 for [(9 – '9.8')+(7 – '8.2')+(5 – '6.6')]/3 A1 for -1200 condone -1.2 SC B1 for 1200 or 1.2

Paper: AST30_01					
Question		Working	Answer	Mark	Notes
10	(a)		Outlier shown	3	M1 for (IQR =) 34-16 or 18 seen M1 for using UQ + (1.5x'IQR') A1 for 66 > 61 oe
	(b)	See appendix 2	Correct box plot and outlier	3	M1 for box plot with any ONE correct value A1 for 3 or 4 correct values A1 for all 5 with outlier correctly shown
11	(a)		1.5 1.2	3	M1 for $\frac{\pm(68-65)}{2}$ or $\frac{\pm(78-72)}{5}$ A1 for 1.5 A1 for 1.2
	(b)		73	2	M1 for 79 + (-1.5 × 4) A1 for 73

Question		Working	Answer	Mark	Notes
12	(a)		0.818	3	M1 for finding $\sum d^2$ must be a difference of ranks. Finding d^2 for at least 5 pairs and adding together.
					M1 for 1-$\frac{6 \times '30'}{10(10^2-1)}$ M1 for 1-$\frac{6 \times '300'}{10(10^2-1)}$
					A1 for 0.818 A1 for -0.818
	(b)(i)		Positive/negative	2	B1 for positive B1 for negative
	(ii)		Correct interpretation		B1 for a correct interpretation of part (b)(i) with context of finishing position and BMI
13	(a)(i)		$x + y$	2	B1 for $x + y$ oe
	(ii)		$x \times y$		B1 for $x \times y$ oe
	(b)(i)	0.4 x 0.5	0.2	3	B1 for 0.2 oe
	(ii)	0.45 + 0.4 – 0.2	0.65		M1 for 0.45 + 0.4 – '0.2' A1 for 0.65 oe

Question		Working	Answer	Mark	Notes
14	(a)		0.9332	2	M1 for $\pm\left(\frac{352-340}{8}\right)$ $(=\pm1.5)$ A1 for 0.9332
	(b)		0.1587	3	M1 for $\pm\left(\frac{348-340}{8}\right)(=\pm1)$ M1 for $1-\mathrm{P}\left(z<\frac{348-340}{8}\right)$ or 1-0.8413 A1 for 0.1587
15	(a)		0.377	2	M1 for $12 \times (0.1)^1 \times (0.9)^{11}$ A1 for awrt 0.377
	(b)		0.659	2	M1 for $(1-0.1)^{12}$ + (their part (a)) A1 for awrt 0.659
	(c)		82 or 83	2	M1 for 125 x 'their part (b)' or 82.3(75..) seen A1 for 82 or 83
16	(a)	$\sum x = 108 \sum y = 601 \sum xy = 7554$	1063.2	2	M1 for $'7554' - \dfrac{'108' \times '601'}{10}$ A1 for 1063.2
	(b)		0.988	2	M1 for $\dfrac{'1063.2'}{\sqrt{319.6 \times 3622.9}}$ A1 for awrt 0.99
	(c)		Correct comment	1	B1 for positive correlation or The longer the drums are kept for then more chemical waste leaking oe or ft their part (b)

Paper: AST30_01					
Question		**Working**	**Answer**	**Mark**	**Notes**
17	(a)		290 5	2	B1 for 290 B1 for 5
	(b)		Normal distribution curve drawn	2	B1 for curve starting at 291 and ending at 309 and being symmetrical about 300 B1 for curve being taller than factory A
	(c)		Two correct comparisons	2	B1 for comparison of average ft their table B1 for comparison of standard deviation ft their table