Mark Scheme (Results)

January 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If working is crossed out and still legible, then it should be given any appropriate marks, as long as it has not been replaced by alternative work.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)
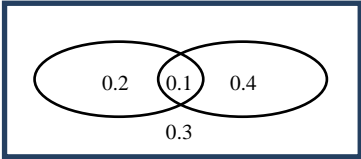indep – independent
isw – ignore subsequent working
awrt – answer which rounds to

Paper: AST30_01				
Question	Working	Answer	Mark	Notes
1 (a)		eg list of all the names	1	B1 for a suitable sampling frame, eg list (of all the names)
(b)		$^{31}/_{180}$	2	M1 for $^{b}/_{180}$ for $b < 180$ or $^{31}/_{a}$ for $a > 31$ A1 for $^{31}/_{180}$ oe
(c)		2	2	M1 for $^{15}/_{180} \times 25$ (=2.08…) A1 for 2 (accept 3)
2 (a)		discrete	1	B1 for discrete (accept quantitative)
(b)		998886 1 57899 775532 2 011578 750 3 046 4 2 6 | 1 represents 16 males 1 | 5 represents 15 females	3	B2 for fully correct ordered stem and leaf diagram (B1 for correct ordered stem and leaf diagram for males or females) B1 for correct key for both males and females
(c)		Interquartile range for females greater than interquartile range for males	2	M1 for 27 – 18 (=9) or 30 – 19 (=11) A1 for 9 and 11 and interquartile range for females greater than interquartile range for males oe
3		box plot	3	M1 for a box plot with at least one of (i) median drawn at 63 (ii) upper quartile drawn in range 73 – 74 and lower quartile drawn in range 51 – 52 (iii) slowest speed drawn at 40 and fastest speed drawn at 87 A1 for 2 correct A1 for all 3 correct

Question		Working	Answer	Mark	Notes
4	(a)		2	1	B1 cao
	(b)		42	2	M1 for 7 + 15 + 9 + 11 (=42) A1 cao
	(c)		$^{24}/_{66}$	2	M1 for $^{a}/_{(5+2+4+11+6+9+29)}$ or $^{a}/_{66}$, for $a < 66$ A1 for $^{24}/_{66}$ oe
5	(a)		tree diagram	3	B1 for branches for Red and Blue AND 6 and not 6 identified M1 for 0.25 and 0.75 or 0.3 and 0.7 A1 for correct tree diagram
	(b)		0.4		M1 for 0.25ד0.7' (=0.175) or '0.3'×0.75 (=0.225) ft their tree diagram M1 for 0.25ד0.7' + '0.3'×0.75 A1 for 0.4 oe
6			comparisons	3	B1 for same medians oe B1 for IQR smaller for 2000 oe or range larger for 2000 oe B1 for negative skew for 2000 and positive skew for 2010 oe
7	(a)		37.1	2	M1 for $^{1855}/_{50}$ A1 cao
	(b)	$\sum fx^2$ = 2700 + 30 625 + 20 000 + 32 000	18.2	3	M1 for $\sum fx^2$ (=85 325) condone one error M1 for $\sqrt{\frac{\sum fx^2}{50} - \left(\frac{1855}{50}\right)^2}$ $(= \sqrt{330.09})$ A1 for 18.1 – 18.2

Question	Working	Answer	Mark	Notes
8 (a)(i)	670×104.1÷100	697.47	3	M1 for '697.47'×105.2÷100 oe A1 for 697.47
(a)(ii)	697.47×105.2÷100 oe	733.74		A1 for 733.74 (accept 733.73)
(b)(i)		104.4	3	M1 for $\sqrt[3]{104.1 \times 105.2 \times 103.9}$ A1 for 104.3 – 104.4
(b)(ii)		4.4		A1 ft for 4.3 – 4.4
9 (a)		correct reason	1	B1 for correct reason, eg cheaper, quicker, less data to process oe
(b)		histogram	3	M1 for 140÷0.5 (=280) or 351÷0.9 (=390) or 156÷1.3 (=120) A1 for bars with correct widths or correct heights A1 for bars with correct widths and correct heights
(c)	40 + 112 = 60	60 and 152 with correct comparison	2	M1 for 20×1 + 50×0.8 (=60) or 40 + 112 (=152) A1 for 60 and 152 with correct comparison, eg more adults (with a body temperature of at most 36.8 $^{\circ}$C) oe
10 (a)		correct advantage	1	B1 for correct advantage, eg quicker
(b)		show outlier	3	M1 for 1.5×(119 – 83) (=54) M1 for 119 + '54' (=173) or 178 – 119 (=59) A1 for correct statement, eg 178 > 173 or 59 > 54
11 (a)		−0.6	2	M1 for ±(450 – 480)÷50 (= ±0.6) A1 cao
(b)		Pam's fish heavier	1	B1 for Pam's fish heavier oe

Paper: AST30_01				
Question	Working	Answer	Mark	Notes
12 (a)		£15	3	M1 for $\frac{45}{n} = \frac{3}{20}$ ($n = 300$) M1 for '300'×0.05 (=15) or '300'×5 (=1500) A1 for £15 or 1500p
(b)		correct reason	1	B1 for correct reason, eg second sample too small
13 (a)		0.9	1	B1 for 0.9 oe
(b)(i)			3	B1 for 0.1 B1 for 0.2 and 0.4 B1 for 0.3 ft provided first B1 awarded
(b)(ii)				B1 for 0.3×0.5 ≠ 0.1 oe OR 0.2 ≠ 0.3, ie $P(C\,\vert\,D) \neq P(C)$
14 (a)		moving average plotted at (2004: 2.5, 48)	3	M1 for (34+54+58+46)÷4 (=48) A1 for moving average plotted at 48 A1 for moving average plotted in correct horizontal position
(b)		downwards	1	B1 for downwards oe
(c)(i)		trend line	4	B1 for appropriate trend line
(c)(ii)		22		M1 for ±[('line' − 70) + ('line' − 50) + ('line' − 34)]÷3, eg [(84 − 70) + (69 − 50) + (54 − 34)]÷3 (= ±17.66…) M1 for 'line' + 'seasonal variation', eg '39' – '17.66…') A1 for 21 – 23 or ft 'line' + 'seasonal variation' provided M1 awarded in part (i)
15		correct sketch	2	M1 for normal distribution with mean 9 A1 for distribution from 6 to 12

Question	Working	Answer	Mark	Notes
16		$^{22}/_{30}$	4	M1 for $^3/_6 \times ^2/_5$ or $^3/_6 \times ^1/_5$ or $^2/_6 \times ^1/_5$ M1 $^3/_6 \times ^2/_5 + ^3/_6 \times ^1/_5 + ^2/_6 \times ^1/_5$ $(= ^{11}/_{30})$ M1 for $2 \times (^3/_6 \times ^2/_5 + ^3/_6 \times ^1/_5 + ^2/_6 \times ^1/_5)$ $(= ^{22}/_{30})$ A1 for $^{22}/_{30}$ oe OR M1 for $^3/_6 \times ^2/_5$ or $^2/_6 \times ^1/_5$ M1 for $^3/_6 \times ^2/_5 + ^2/_6 \times ^1/_5$ M1 for $1 - (^3/_6 \times ^2/_5 + ^2/_6 \times ^1/_5)$ $(= ^{22}/_{30})$ A1 for $^{22}/_{30}$ oe OR M1 for $^3/_6 \times ^3/_5$ or $^2/_6 \times ^4/_5$ or $^1/_6 \times ^5/_5$ M2 for $^3/_6 \times ^3/_5 + ^2/_6 \times ^4/_5 + ^1/_6 \times ^5/_5$ $(= ^{22}/_{30})$ A1 for $^{22}/_{30}$ oe [SC B2 for $^{22}/_{36}$ oe]
17 (a)		$S_{yy} = 14.2*$	2	M1 for '123.72' – '29.6'^{2}÷8 condone one error in calculating either $\sum y^2$ or $\sum y$ A1 for 14.2 cso
(b)(i)		0.278	2	M1 for $3.4 \div (\sqrt{(10.5 \times 14.2)}$ A1 for 0.278 – 0.279
(b)(ii)		correct reason	1	A1 ft for correct reason, eg value of correlation coefficient is low

Paper: AST30_01				
Question	Working	Answer	Mark	Notes
18 (a)		0.776	2	M1 for $(1 - {}^{1}\!/_{40})^{10}$ A1 for 0.77 – 0.78
(b)		0.0230	2	M1 for ${}^{10}C_2 \times ({}^{1}\!/_{40})^2 \times (1 - {}^{1}\!/_{40})^8$ A1 for 0.022 – 0.023
19 (a)		0.1056	3	M1 for $\pm(200 - 225) \div 20$ $(= \pm1.25)$ M1 for $1 - 0.8944$ or $1 - \Phi('1.25')$ A1 cao
(b)		277	3	M1 for $\Phi[(235 - 225) \div 20]$ $(= 0.6915)$ M1 for $400 \times '0.6915'$ A1 for 270 – 280