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Mark Scheme (Results)

January 2016

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If working is crossed out and still legible, then it should be given any appropriate marks, as long as it has not been replaced by alternative work.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 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)		Complete diagram	2	B2 for fully correct entries, condone missing brackets (B1 for any 3 rows or any 3 columns with correct entries)
	(b)		$^1/_{16}$	1	B1 for $^1/_{16}$ oe
	(c)	$^1/_{16} \times 320$	20	2	M1 for '($^1/_{16}$)'× 320 A1 cao
2	(a)		Cumulative frequency graph drawn	3	M1 for points plotted consistently within the intervals M1 for points plotted at the correct heights A1 for all points plotted correctly at end points and joined up with a curve. (condone line segments)
	(b)(i)		13	3	B1 for 13 - 13.5 **or** ft their cumulative frequency graph (Must be a cumulative frequency graph)
	(ii)	17.5 – 9.5	8		M1 for 17.5 and 9.5 **or** ft their cumulative frequency graph (Must be a cumulative frequency graph) A1 for 8 **or** ft their cumulative frequency graph
	(c)		Box plot drawn	3	M1 for a box plot with at least 2 points plotted correctly. A1 for smallest and largest and 'Q2' plotted correctly A1 'Q1' and 'Q3' plotted correctly

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Question		**Working**	**Answer**	**Mark**	**Notes**
3	(a)		Advantage and disadvantage	2	B1 for advantage e.g. quicker, cheaper, easier o.e B1 for disadvantage e.g. unreliable o.e
	(b)		106, 129, 126	3	B1 for 106 B1 for 129 B1 for 126
	(c)		2 comparisons	2	B2 for two correct comparisons from 1. Comparison of medians e.g. median for action > median for comedy 2. Comparison of IQR/range e.g. IQR for action < IQR for comedy 3. Comparison of skew e.g. Action positive skew and comedy negative skew (B1 for one correct comparison)
	(d)	$121 - 1.5 \times 17 = 95.5$ $90 < 95.5$	Jas is correct with correct reasoning	2	M1 for a complete correct method e.g. $121 - 1.5 \times (138 - 121)$ (= 95.5) A1 for correct reason with working (Jas is correct or 90 is an outlier)

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Question		**Working**	**Answer**	**Mark**	**Notes**
4	(a)		Tree diagram	3	B1 for £2 and £1 at the end of branches for bag A and £1 and £5 at the end of branches for bag B B1 for ¾ and ¼ in the correct place for bag A B1 for $^{2}/_{3}$ and $^{1}/_{3}$ in the correct places for bag B
	(b)	$^{3}/_{4} \times {}^{1}/_{3}$	$^{3}/_{12}$	2	M1 for '($^{3}/_{4} \times {}^{1}/_{3}$)' A1 for $^{3}/_{12}$ oe
5	(a)		Correct advantage	1	B1 for advantage e.g. quicker, cheaper, easier oe
	(b)		Suitable sampling frame	1	B1 for a **list** of all **drivers** **or** a **list** of all **people** who have **membership** (all may be implied but do not accept a statement that is an incomplete sampling frame)
	(c)	$(^{350}/_{2100}) \times 60$	10	2	M1 for a fully correct method A1 cao

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Question		**Working**	**Answer**	**Mark**	**Notes**
6	(a)	$^{40}/_{5} \times 40$	320	2	M1 for a correct method e.g. $^{40}/_{5} \times 40$ A1 cao
	(b)		Correct assumption	1	B1 for a correct assumption e.g. the population has not changed **or** the tags have not come off **or** the probability of being caught is equal for all individuals
7	(a)		Upward	1	B1 for upward oe
	(b)	(15 – 13 + 0 + 18 – 19) ÷ 3	333.33	3	M1 for either 15 (000) – 13 (000) (= ±2 (000)) or 17 (000) – 17 (000) (= 0) or 18 (000) – 19 (000) (= ±1 (000)) M1 for (15 (000) – 13 (000) + 0 + 18 (000) – 19 (000)) ÷ 3 (=0.333…) A1 for (£) 333.33 **or** (£) 333

PAPER: AST30_01					
Question		**Working**	**Answer**	**Mark**	**Notes**
8	(a)	$^{120}/_{105} \times 100$ $^{125}/_{120} \times 100$ $^{140}/_{125} \times 100$	114 104 112	2	M1 for any one of $^{120}/_{105} \times 100$ **or** $^{125}/_{120} \times 100$ **or** $^{140}/_{125} \times 100$ (maybe implied by one correct answer) A1 cao
	(b)	$\sqrt[3]{114 \times 104 \times 112}$	110	2	M1 for $\sqrt[3]{'114' \times '104' \times '112'}$ A1 cao
	(c)		Correct interpretation	1	There is an (average) **annual increase** of **'10'%**
9	(a)	Frequency densities 1.2, 3.8, 5.3, 3.7, 0.75, 0.1	Histogram	4	M1 for frequency densities A1 for correct partitioning on the *x* axis A1 for correct bar heights B1 for a suitable scale and label on the *y* axis
	(b)	(42.5 × 6 + 47.5 × 19 + … + 120 × 6) ÷ 136	61.746…	3	M1 for $f \times x$ consistent in interval M1 for $\sum f \times x \div 136$ (maybe implied by 8397.5 ÷ 136) A1 for 61.7 – 61.75
	(c)	$\sqrt{\frac{552756.25}{136} - (\frac{8397.5}{136})^2}$	15.87	2	M1 for $(^{552756.25}/_{136}) - (b)^2$ A1 for awrt 15.9

PAPER: AST30_01

Question		Working	Answer	Mark	Notes
10	(a)	$(52 - 45.4) \div 3.6$	1.8333…	2	M1 for $\pm(52 - 45.4) \div 3.6$ A1 for awrt 1.8
	(b)		Correct interpretation	1	B1 for Taylor as her standardised score is higher **or** ft from part (a)
11	(a)	d | d^2 4 | 16 2 | 4 2 | 4 -3 | 9 -3 | 9 4 | 16 -1 | 1 -5 | 25 Total | 84 $1 - \frac{6 \times 84}{8(8^2 - 1)}$	0	3	M1 for finding $\sum d^2$ (allow one error) M1 for using $1 - \frac{6 \times their \sum d^2}{8(8^2-1)}$ A1 cao
	(b)		No correlation	1	B1 for No correlation/No agreement between the judges oe **or** ft from part (a) provided $-1 \leq r_s \leq 1$

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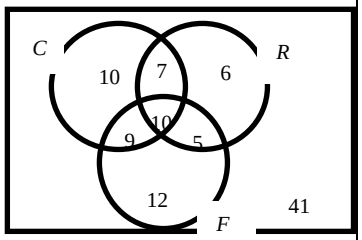
Question		**Working**	**Answer**	**Mark**	**Notes**
12	(a)		Venn diagram drawn	3	B1 for 7 **or** 9 **or** 5 in the right place B1 for 10 **and** 6 **and** 12 in the right place B1 for 41 in the right place
	(b)(i)		$^{10}/_{100}$	4	B1 oe
	(ii)		$^{41}/_{100}$		B1 for $^{41}/_{100}$ oe **or** ft their Venn diagram
	(iii)		$^{17}/_{100}$		M1 for $^{(\text{'10'} + \text{'7'})}/_{100}$ A1 for $^{17}/_{100}$ oe **or** ft their Venn diagram

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Question		**Working**	**Answer**	**Mark**	**Notes**
13	(a)		Mutually exclusive	1	B1 cao
	(b)	$^3/_{10} + {}^2/_5 - {}^1/_2$	$^1/_5$	2	M1 for $^3/_{10} + {}^2/_5 - {}^1/_2$ A1 cao
	(c)	$^1/_5 \div {}^3/_{10}$	$^2/_3$	2	M1 for '$(^1/_5)$' $\div {}^3/_{10}$ A1ft
14	(a)		Sketch	3	M1 for a bell shaped curve A1 for symmetry about the mean 4.5 **or** for the curve starting at 3.3 and ending at 5.7 A1 cao
	(b)	$P(\frac{4.8-4.5}{0.4} < z < \frac{5.2-4.5}{0.4})$ 0.9599 – 0.7734	0.1865	4	M1 for either $\frac{4.8-4.5}{0.4}$ (=0.75) or $\frac{5.2-4.5}{0.4}$ (=1.75) M1 for $\frac{4.8-4.5}{0.4}$ (=0.75) and $\frac{5.2-4.5}{0.4}$ (=1.75) M1 for 0.9599 – 0.7734 A1 cao
	(c)		Two correct comparisons	2	B1 for a comparison of average e.g. mean/median/mode for house flies < mean/median/mode for bottle flies B1 for a comparison of spread e.g. standard deviation for house flies < standard deviation for bottle flies (accept range) (**or** ft from their graph)

PAPER: AST30_01					
Question		**Working**	**Answer**	**Mark**	**Notes**
15		${}^{12}C_2\ 0.4^2\ 0.6^{10}$	0.06385…	3	B1 for ${}^{12}C_2$ M1 for … $0.4^2\ 0.6^{10}$ A1 for 0.063 – 0.064
16	(a)		9.7	1	B1 for awrt 9.7
	(b)	$\frac{72.1}{\sqrt{571.4\ \times 9.7}}$	0.968	3	B1 for $\frac{S_{ah}}{\sqrt{S_{aa} \times S_{hh}}}$ M1 for $\frac{72.1}{\sqrt{571.4 \times 9.7}}$ A1 for awrt 0.96(8)
	(c)(i)			2	B1 for positive correlation **or** ft provided M1 is awarded in part (b)
	(ii)				B1 for as the players ages increases so does their height **or** ft provided M1 is awarded in part (b)

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