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Mark Scheme (Results)

Summer 2014

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If working is crossed out and still legible, then it should be given any appropriate marks, as long as it has not been replaced by alternative work.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

9 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 canceling 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.

10 Probability

Probability answers must be given a 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.

11 Linear equations

Full marks can be gained if the solution alone is given on the answer line, or otherwise unambiguously indicated in working (without contradiction elsewhere). Where the correct solution only is shown substituted, but not identified as the solution, the accuracy mark is lost but any method marks can be awarded.

12 Parts of questions

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

13 Range of answers

Unless otherwise stated, when an answer is given as a range (e.g 3.5 – 4.2) then this is inclusive of the end points (e.g 3.5, 4.2) and includes all numbers within the range (e.g 4, 4.1)

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

PAPER: AST30_01					
		Working	**Answer**	**Mark**	**Notes**
1	(a)(i)		e.g. Cheaper/Quicker	1	B1 for cheaper/quicker oe
	(ii)		A **list** of all students in the school	1	B1 for **list** of students oe
	(b)		e.g. the sample is too small	1	B1 sample is too small or biased or only people that do Maths or all members are a similar age oe
2		$\frac{135}{1200} \times 60$	7	2	M1 for $\frac{135}{1200} \times 60$ (=6.75) A1 cao
3		$\sqrt{\frac{6587.5}{22} - \left(\frac{'345'}{22}\right)^2}$	7.32	4	M1 for Σfx (= 345) (Condone one error) M1 for (variance =) $\frac{6587.5}{22} - \left(\frac{'345'}{22}\right)^2$ M1 (dep) for $\sqrt{\frac{6587.5}{22} - \left(\frac{'345'}{22}\right)^2}$ A1 awrt 7.3

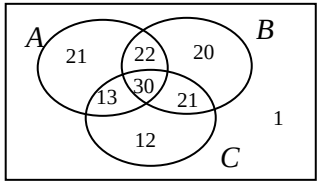
PAPER: AST30_01					
		Working	**Answer**	**Mark**	**Notes**
4	(a)	Lyndon Bevan 6 5 5 3 1 | 2 8 6 5 | 3 | 6 7 3 2 | 4 | 4 6 6 1 | 5 | 2 3 4 5 | 6 | 4 8 Key Lyndon 1 | 2 means 21 minutes Bevan 3 | 6 means 36 minutes	Ordered back to back stem and leaf diagram drawn	4	B3 for correct ordered leaves for both Lyndon and Bevan (B2 for correct ordered leaves for either Lyndon or Bevan) (B1 for correct diagram with at most 2 errors in leaves) B1for correct key
	(b)		3 correct comparisons	3	B3 for 3 correct comparisons from the following: • For a correct comparison of an average e.g. median/mean/mode for Bevan > median/mean/mode for Lyndon • For a correct comparison of spread e.g. IQR for Lyndon > IQR for Bevan or range for Bevan > range for Lyndon • For a correct comparison of skew e.g. both are negatively skewed • For a correct overall conclusion e.g. Bevan spent more time on his mobile phone (B2 for any two correct comparisons) (B1 for any one correct comparison)

PAPER: AST30_01					
		Working	**Answer**	**Mark**	**Notes**
5	(a)(i)		60	3	M1 for ordering the data A1 for 60 cao
	(a)(ii)	64 – 54.5	9.5		A1 for 9.5 cao
	(b)	54.5– 1.5 × 9.5 = 40.25 39.5 < 40.25, so an outlier	Show outlier	2	M1 for '54.5' – 1.5 × '9.5' (= 40.25) A1 for correct comment, eg 39.5 < '40.25'
	(c)	Lowest 40.25/52.5 LQ 54.5 Median 60 UQ 64 Highest 65	Box plot drawn	3	B3 for box plot with 3 correct features from: 1. median marked correctly 2. lq and uq marked correctly 3. outlier and highest value marked correctly and lowest value marked at '40.25' or 52.5 (B2 for 2 correct B1 for 1 correct)
6	(a)		(3, 1), (1, 3), (4, 2), (2, 4), (5,3), (3, 5), (6,4), (4, 6)	2	B2 for 8 combinations (B1 for at least 4 combinations)
	(b)		$\frac{8}{36}$	1	B1 for $\frac{'8'}{36}$ oe
	(c)	$\frac{8}{36} \times 180$	40	2	M1 $'(\frac{8}{36})' \times 180$ A1 cao

PAPER: AST30_01					
		Working	**Answer**	**Mark**	**Notes**
7	(a)	80 : x = 10 : 80	640	2	M1 for a correct method e.g. 80 : x = 10 : 80 oe A1 cao
	(b)		Correct assumption	1	B1 for a correct assumption from the population has not changed oe or the marks haven't come off or the population is randomly distributed e.g. the frogs are mixed up between samples oe
8	(a)		Upward	1	B1 for upward oe
	(b)	612 – 490	122	2	M1 for 610⩽ Value ⩽ 620 – 490 A1 for answer in the range 120 to 130 inclusive
9	(a)	0.3, 0.7 and 0.2, 0.8 and 0.2, 0.8	Complete the tree diagram	3	B1 for correct probabilities on brakes branches B1 for correct probabilities on exhaust branches B1 for correct labels
	(b) (i)	0.3 × 0.2	0.06	2	M1 for 0.3 ×0.2 or ft from their tree diagram A1 for 0.06 oe
	(ii)	0.3 × 0.8 + 0.7 × 0.2	0.38	2	M1 for 0.3 × 0.8 + 0.7 × 0.2 or ft from their tree diagram A1 for 0.38 oe

PAPER: AST30_01					
		Working	**Answer**	**Mark**	**Notes**
10	(a)	4+0+1+4+16+4+0+9+1+1 $1-\frac{6\times 40}{10(10^2-1)}$	0.76	3	M1 for an attempt at $\sum d^2$ (=40 or 290) M1 for $1-\frac{6\times\prime 40\prime}{10(10^2-1)}$ or $1-\frac{6\times\prime 290\prime}{10(10^2-1)}$ A1 awrt $\pm$(0.75 to 0.76)
	(b)		Correct Interpretation	1	B1 ft (this only follows through for a sensible answer in part a) for the taller the athlete the higher their position in the throwing competition (accept positive correlation/negative correlation, ignore reference to strength) oe
11	(a)	Art $\frac{77-70}{5}$ Music $\frac{70-65}{2.5}$	Art 1.4 Music 2	3	M1 for either $\pm\frac{77-70}{5}$ or $\pm\frac{70-65}{2.5}$ A1 for 1.4 A1 for 2
	(b)		Music and reason	1	B1 for Music as her standardised score was larger or ft from part (a) provided M1 was scored
	(c)	- 1.5 × 4 + 58	52	2	M1 for – 1.5 × 4 + 58 A1 cao

PAPER: AST30_01					
		Working	**Answer**	**Mark**	**Notes**
12	(a)		correct interpretation	1	B1 for there is an increase of 0.3**% (**from May to June)
	(b)		100.4, 100.5	2	M1 for either $\frac{28973}{28860} \times 100$ (=100.4…) or $\frac{29132}{28973} \times 100$ (=100.5…) A1 for both awrt 100.4 and awrt 100.5)
	(c)	$\sqrt[4]{100.5 \times 100.3 \times 100.4 \times 100.5}$	100.4	2	M1 for the 4th root of the product of their 4 numbers A1 for awrt 100.4
	(d)		Average rate of increase is 0.4% per month	2	B1 ft for **average** rate of **increase** is '0.4'% B1 for per **month**

PAPER: AST30_01					
		Working	**Answer**	**Mark**	**Notes**
13	(a)		Completed Venn diagram	3	B3 for all numbers in the correct place (B2 for 5 numbers in the correct place) (B1 for 3 or 4 numbers in the correct place)
	(b) (i)		$\frac{1}{140}$	1	B1 for $\frac{1}{140}$ oe or ft from the Venn diagram
	(ii)		$\frac{34}{140}$	2	M1 for '13' + '21' (=34) A1 for $\frac{34}{140}$ oe
14	(a)		2 normal distribution curves drawn	4	B1 for 2 bell shaped curves drawn and labelled French and German B1 for a bell shaped curve starting at 50 and ending at 80 B1 for a bell shaped curve starting at 49 and ending at 67 B1(Dep on 1st B1) for German curve taller than French curve
	(b)		2 correct comparisons	2	B2 Any 2 from 1. a comparison of average 2. a comparison of spread 3. a comparison of which subject had the better results (B1 for any one comparison)

PAPER: AST30_01					
		Working	**Answer**	**Mark**	**Notes**
15		${}^{10}C_6\ 0.3^6\ 0.7^4$	0.037	3	B1 for ${}^{10}C_6$ or 210 M1 for ${}^{10}C_6\ 0.3^6\ 0.7^4$ oe A1 for awrt 0.04
16	(a)	$654.006 - \frac{91 \times 49.56}{7}$	9.726	1	B1 for 9.726 (accept 9.73)
	(b)	$\frac{9.726}{\sqrt{8.72 \times 11.278}}$	0.98	3	M1 for use of $\frac{S_{xy}}{\sqrt{S_{xx} \times S_{yy}}}$ M1 for $\frac{9.726}{\sqrt{8.72 \times 11.278}}$ (=0.98075) A1 for awrt 0.98
	(c)		Correct relationship	1	B1 for as the amount of rainfall in the growing season increases the yield of a crop increases oe, accept positive correlation NB Do not accept positive on its own

PAPER: AST30_01					
		Working	**Answer**	**Mark**	**Notes**
17	(a)		$\frac{2}{3}$	1	B1 for $\frac{2}{3}$ oe
	(b)	$\frac{2}{3} \times \frac{3}{4}$	$\frac{1}{2}$	1	B1 for $\frac{1}{2}$ oe
	(c)	$\frac{2}{3} + \frac{3}{4} - \frac{1}{2}$	$\frac{11}{12}$	2	M1 for $\frac{2}{3} + \frac{3}{4} - '(\frac{1}{2})'$ A1 cao
18	(a)	Let H be rv height of men, so $H \sim N(178, 6.2^2)$ $P(H > 186) = P(Z > \frac{186-178}{6.2})$ $P(Z > 1.29) = 1 - P(Z < 1.29)$	0.0985	3	M1 for $\pm(\frac{186-178}{6.2})$ M1 for 1 - P(Z < 1.29) A1 cao
	(b)	Let W be rv weight of men, so $W \sim N(82, 7.6^2)$ $P(W < 89) = P(Z < \frac{89-82}{7.6}) = P(Z < 0.92)$	0.8212	2	M1 for $\frac{89-82}{7.6}$ A1 cao
	(c)	$P(H > 186 \ \& \ W < 89) = 0.0985 \times 0.8212$	0.0808882	2	M1 '0.0985' × '0.8212' A1 for answer between 0.08 and 0.081

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