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Mark Scheme (Results)

Summer 2014

Pearson Edexcel Level 2 Award in Statistical Methods (AST20)

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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If working is crossed out and still legible, then it should be given any appropriate marks, as long as it has not been replaced by alternative work.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 ft – follow through sc – special case dep – dependent (on a previous mark or conclusion) indep – independent isw – ignore subsequent working

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		Working	Answer	Mark	Notes
1	(a)		<table><tr><td></td><td>Thu</td><td>Fri</td><td>Sat</td><td>T</td></tr><tr><td>M</td><td>23</td><td>**(26)**</td><td>44</td><td>**[93]**</td></tr><tr><td>A</td><td>20</td><td>**18**</td><td>**(32)**</td><td>70</td></tr><tr><td>E</td><td>35</td><td>30</td><td>**[37]**</td><td>102</td></tr><tr><td>T</td><td>**[78]**</td><td>**(74)**</td><td>113</td><td>265</td></tr></table>	3	B3 cao (B2 for 26 or 74 or 32 correct B1 for 78 or 37 or 93 correct)
2	(a)		<table><tr><td>(R, R)</td><td>**(R, Y)**</td><td>**(R, W)**</td></tr><tr><td>**(G, R)**</td><td>**(G, Y)**</td><td>**(G, W)**</td></tr><tr><td>**(O, R)**</td><td>**(O, Y)**</td><td>**(O, W)**</td></tr></table>	2	B2 cao (B1 for at least 1 row correct or one column correct) NB accept letters in reverse order, brackets not needed
	(b)(i)		$\frac{1}{9}$	3	M1 for $\frac{a}{9}$ for $a < 9$ A1 for $\frac{1}{9}$ oe
	(b)(ii)		$\frac{5}{9}$		A1 for $\frac{5}{9}$ oe (SC B1 for $\frac{1}{b}$ and $\frac{5}{b}$ for $b > 5$ OR 1:9 or 5:9)
3	(a)		As density increases speed decrease	1	B1 for eg as density increases speed decrease, accept negative correlation
	(b)(i)		(1.25, 337) plotted	2	B1 for (1.25, 337) plotted (overlay)
	(b)(ii)		Line of best fit drawn		B1 for suitable line of best fit need not pass through mean point
	(c)		318 – 325	1	B1 for 318 – 325

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		Working	**Answer**	**Mark**	**Notes**
4	(a)		$\frac{7}{10}$	2	M1 for $1 - \frac{3}{10}$ oe A1 for $\frac{7}{10}$ oe
	(b)		90	2	M1 for $\frac{3}{10} \times 300$ oe A1 cao (SC B1 for 210 or $\frac{90}{300}$)
	(c)		correct decision + reason	2	M1 for $\frac{1}{6} \times 120$ (=20) or $\frac{12}{120}$ oe A1 for decision + correct reason, eg yes, only landed on five 12 times or yes, probability should be $\frac{1}{6}$ OR B2 for don't know oe + correct reason eg, 12 is a possible outcome (if unlikely)
5	(a)		Continuous + reason	1	B1 for continuous (data) + reason, eg can take any value in a given interval/range, accept it's a measurement oe
	(b)		2, 4, 8, 12, 4	2	M1 for using tallies or at least one correct frequency A1 for 5 correct tallies or 5 correct frequencies
	(c)		$15 < w \leq 16$	1	B1 for $15 < w \leq 16$ or ft their table
	(d)		correct histogram drawn	3	B1 for frequency density oe accept frequency M1 for suitable linear scales on both axes A1 for correct bars with relative heights 2, 4, 8, 12, 4 or ft their table

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		Working	**Answer**	**Mark**	**Notes**
6			two things correctly identified	2	B2 for any two correct from 1 3D (graph misrepresents information or harder to read oe) 2 missing ingredient/label oe 3 no units oe 4 similar shading oe 5 inconsistent labelling oe 6 separated segments oe (B1 for one correct)
7	(a)		Question + response boxes	2	B1 for a suitable question B1 for at least 3 non-overlapping exhaustive response boxes (NB units of time, eg minutes, must appear with question or response boxes)
	(b)(i)		Advantage	2	B1 for advantage, eg saves time, saves money, easier to do, etc
	(ii)		Correct reason		B1 for suitable reason, eg not representative oe
8	(a)	(105+360+825+1235+900 +255) ÷ 60 3680 ÷ 60 =	61.3	4	M1 for fx with x consistent within intervals (including end points) condone one error in multiplication M1 (dep) for use of midpoints condone one error M1 (dep on first M1) for use of $\sum fx \div 60$ A1 for 61.3 – 61.4 accept $61^1/_3$
	(b)		(3), 11, 26, 45, 57, 60	1	B1 cao
	(c)		correct cumulative frequency graph	2	M1 for plotting values consistently within each interval (overlay) ft their sensible table (condone one error) A1 for correct cf graph accept line segments
	(d)		8	2	B2 for 7 or 8 or 9 OR ft their sensible cf graph (B1 for line drawn at 75)

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		Working	**Answer**	**Mark**	**Notes**
9	(a)	(IQR =) 32 – 20	(median =) 31 (IQR =) 12	3	B1 for 31 M1 for 20 and 32 identified A1 cao
	(b)	range FU=43–18(=25) range DG=42–19(=23)	correct comparisons	2	B1 ft for comparing medians or means or modes, eg median DG > median FU oe or eg DG are (generally) older (than FU) B1 ft for comparing IQRs or ranges or skews, eg IQR DG > IQR FU OR range FU > range DG OR FU positive skew and DG no skew
10	(a)		$5.5 < w \leq 6.5$	1	B1 for $5.5 < w \leq 6.5$
	(b)	5, 9, 14, 21, 16	correct frequency polygon	2	M1 for plotting weights consistently within each interval including ends A1 cao (ignore extra lines drawn at ends)
	(c)		negative skew	1	B1 for negative (skew)
11	(a)		20	1	B1 cao
	(b)		11	2	M1 for 23 and 12 seen together A1 cao (SC B1 for 10)
	(c)	3, 9, 17, 21, 33	correct box plot	2	M1 for a box plot with at least 3 correct features A1 cao
	(d)		both negative	1	B1 for both negative oe, eg A has greater (negative) skew or both same type (of skew) provided these are not stated as positive

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		Working	**Answer**	**Mark**	**Notes**
12	(a)		correct time-series	2	M1 for plotting at quarters 1, 2, 3 and 4 A1 for correct heights, line segments not needed (overlay)
	(b)		700, 725, 750, 775, 800	3	M1 for attempt to calculate a 4-point moving average, eg (900+750+500+650)÷4 or 700 or 725 or 750 or 775 or 800 seen A1 for at least three correct A1 cao
	(c)		upwards	1	B1 for upwards oe
	(d)(i)		114.3	2	M1 for 3200÷2800×100 (=114.28…) A1 for 114.2 – 114.3
	(ii)		14.3% increase	1	A1 ft for 14% – 14.3% and increase oe
13		48+357+265 = 670 Asia = 3.58… Europe = 26.64… America = 19.77…	Asia 4 Europe 26 America 20	3	M1 for eg 48 ÷ (48+357+265) × 50 oe A1 for two of 3 – 4 or 26 – 27 or 19 – 20 A1 for 4, 26, 20 or 3, 27, 20 or 4, 27, 19 correctly identified (SC if no working B3 for 4, 26, 20 or 3, 27, 20 or 4, 27, 19 correctly identified B2 for two of 4, 26, 20 or 3, 27, 20 or 4, 27, 19 correctly identified B1 for one of 4, 26, 20 or 3, 27, 20 or 4, 27, 19 correctly identified)
14	(a)		80	1	B1 cao
	(b)	1485 ÷ 40	37.125	3	M1 for 15 × 43 (=510) or 25 × 39 (=975) M1 for (‘510’+’975’) ÷ 40 A1 for 37.1 – 37.13

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		Working	**Answer**	**Mark**	**Notes**
15	(a)	0.65, 0.35 0.7, 0.3 and 0.7, 0.3	Tree diagram	3	M1 for probability tree diagram with 0.65 and 0.35 OR 0.7 and 0.3 paired (ignore labelling) M1 for two stage probability tree diagram with 0.65 and 0.35 AND 0.7 and 0.3 paired at least once (ignore labelling) A1 for correct tree diagram and all branches identified
	(b)(i)		0.455	1	M1 for 0.65 × 0.7 (=0.455)
	(ii)		0.195	2	M1 for 0.65 × '0.3' (=0.195) A1 for 0.455 and 0.195 oe
16			1.8	3	M1 for 72 ÷ 15 (=4.8) M1 for 396 ÷ 15 – '4.8'^{2} (=3.36) A1 for 1.8 – 1.9 OR (substitution into formula) M1 for $\frac{396}{15} - \left(\frac{72}{15}\right)^2$ M1 for $\sqrt{\frac{396}{15} - \left(\frac{72}{15}\right)^2}$ A1 for 1.8 – 1.9

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