

# Mark Scheme (Results)

Summer 2016

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If working is crossed out and still legible, then it should be given any appropriate marks, as long as it has not been replaced by alternative work.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

Probability answers must be given as 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.

### **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



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Question	Working	Answer	Mark	Notes						
1		<table border="1"> <tr> <td>The number of people in an office</td> <td>Discrete</td> </tr> <tr> <td>The length of a fence</td> <td>Continuous</td> </tr> <tr> <td>The colour of a sofa</td> <td>Categorical</td> </tr> </table>	The number of people in an office	Discrete	The length of a fence	Continuous	The colour of a sofa	Categorical	2	B2 cao (B1 for one correct)
The number of people in an office	Discrete									
The length of a fence	Continuous									
The colour of a sofa	Categorical									
2 (a)		Correct frequency polygon	2	M1 for plotting consistent within each interval including ends or for a frequency polygon plotted at mid-points with at most one error or for plotting all points correctly within each interval, but not joining A1 cao						
(b)		$40 < w \leq 60$	1	B1 for cao						
3 (a)		LOBF	1	B1 for suitable LOBF						
(b)		Negative	1	B1 for negative						
(c)		The higher the age the lower the price	1	B1 for the higher the age the lower the price oe						
(d)(i)		Outlier	3	B1 for outlier. Allow anomaly.						
(ii)		Correct reason and no		B1for correct reason eg 'It is more expensive' oe B1dep Don't buy it oe						

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<b>Question</b>	<b>Working</b>	<b>Answer</b>	<b>Mark</b>	<b>Notes</b>
4 (a)		0.11	2	M1 for $1-(0.14+0.18+0.27+0.21+0.09)$ A1 for cao
(b)		0.66	2	M1 for $0.18+0.27+0.21$ A1 for cao
(c)		63	2	M1 for $0.18 \times 350$ A1 for cao
(d)		Correct reason	1	B1 for a correct reason E.g. Anything which implies that theoretical probability is not the same as experimental probability.
5 (a)		Question and response boxes	2	B1 for suitable question with time frame (NB time frame could occur with question or response boxes) B1 for at least 3 non-overlapping exhaustive response boxes.
(b)(i)		Correct reason	2	B1 for correct reason from Quicker/cheaper/easier/less data to handle
(ii)		Correct reason		B1 for a correct reason from Sample not random Sample too small It's only the people queuing up Sample not representative of the population People in the queue are going to the arts centre



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Question	Working	Answer	Mark	Notes
6 (a)		12, 28, 75, 114, 120	1	B1 for cao
(b)		(40,2), (50,12),(60,28),(70,75), (80,114), (90,120) with curve or line segments	2	M1 for points plotted consistently in each interval and joined with a curve or line segments ft part (a) condone one error in plotting. A1 cao
(c)		12	2	M1 use of cumulative frequency graph to find 'uq'-'lq' A1 for 12 or ft provided M1 gained in (b).
(d)		38-48	2	M1 for a line drawn from 45 or 65 from the speed axis and then to the cf axis. A1 for answer in the range
7		Two correct reasons	2	B2 for any two correct from Missing bar / No fans were sold in Autumn Missing label on horizontal axis Bar is at an angle No title Scale not going up in equal intervals
8	$(1 \times 15 + 2 \times 11 + 3 \times 6 + 4 \times 9 + 5 \times 4) \div 45$	2.47	3	M1 for $\sum fx$ (may be implied by 111) M1 for ' $\sum fx$ ' $\div 45$ A1 for 2.46-2.47 or 2.5 with working or 2 with working

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Question	Working	Answer	Mark	Notes												
9 (a)   (b)(i)  (ii)		<table border="1" style="margin-left: auto; margin-right: auto;"> <tr><td></td><td></td><td></td><td>2</td></tr> <tr><td></td><td></td><td>1</td><td>0</td></tr> <tr><td>5</td><td>4</td><td>3</td><td>2</td></tr> </table> $\frac{1}{12}$ $\frac{8}{12}$				2			1	0	5	4	3	2	2   3	B2 for all correct B1 for at least 4 correct  B1 for ft from table  M1 $a/12$ for $a < 12$ or $8/b$ for $b > 8$ A1 $\frac{8}{12}$ oe
			2													
		1	0													
5	4	3	2													
10 (a)   (b)  (c)		<table style="margin-left: auto; margin-right: auto;"> <tr><td style="border-right: 1px solid black; padding-right: 5px;">1</td><td style="padding-left: 5px;">3 4 6</td></tr> <tr><td style="border-right: 1px solid black; padding-right: 5px;">2</td><td style="padding-left: 5px;">2 7 8 9</td></tr> <tr><td style="border-right: 1px solid black; padding-right: 5px;">3</td><td style="padding-left: 5px;">1 3 4 6 7</td></tr> <tr><td style="border-right: 1px solid black; padding-right: 5px;">4</td><td style="padding-left: 5px;">4 7 9</td></tr> </table> <p style="margin-left: 100px;">Key 1 3 means 13 miles</p> $31$ $15$	1	3 4 6	2	2 7 8 9	3	1 3 4 6 7	4	4 7 9	3   1  2	B1 for correct stem (1, 2, 3, 4) B1 for correct leaves in order B1 for correct key  B1 ft from an ordered stem and leaf  M1 for 37-22 or ft from their ordered stem and leaf diagram A1 for cao				
1	3 4 6															
2	2 7 8 9															
3	1 3 4 6 7															
4	4 7 9															

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Question	Working	Answer	Mark	Notes																
11 (a)		Positive	1	B1 for positive																
(b)		Correct box plot drawn	2	M1 for box plot and 3 correct values plotted A1 for all correct																
(c)	<table border="1"> <thead> <tr> <th></th> <th>Mon</th> <th>Tues</th> </tr> </thead> <tbody> <tr> <td>Med</td> <td>18</td> <td>25</td> </tr> <tr> <td>Range/IQ</td> <td>49/18</td> <td>56/21</td> </tr> <tr> <td>R</td> <td></td> <td></td> </tr> <tr> <td>Skew</td> <td>positive</td> <td>negative</td> </tr> </tbody> </table>		Mon	Tues	Med	18	25	Range/IQ	49/18	56/21	R			Skew	positive	negative	2 correct comparisons	2	B2 for two correct comparisons from 1. Median for Tuesday > Median for Monday 2. Range for Tuesday > Range for Monday OR IQR for Tuesday > IQR for Monday 3. Monday positive skew AND Tuesday negative skew	
	Mon	Tues																		
Med	18	25																		
Range/IQ	49/18	56/21																		
R																				
Skew	positive	negative																		
12		<table border="1"> <thead> <tr> <th></th> <th>Watched</th> <th>Not watched</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td>Boys</td> <td>21</td> <td>7</td> <td>28</td> </tr> <tr> <td>Girls</td> <td>23</td> <td>19</td> <td>42</td> </tr> <tr> <td>Total</td> <td>44</td> <td>26</td> <td>70</td> </tr> </tbody> </table>		Watched	Not watched	Total	Boys	21	7	28	Girls	23	19	42	Total	44	26	70	3	B1 for 19, 21, 42 <b>and</b> 70 B1 for 23 <b>and</b> 28 B1 for completely correct
	Watched	Not watched	Total																	
Boys	21	7	28																	
Girls	23	19	42																	
Total	44	26	70																	
13 (a)		$12 < t \leq 16$	1	B1 for cao																
(b)	$(2 \times 6) + (6 \times 9) + (10 \times 13) + (14 \times 18) + (18 \times 10) + (22 \times 4) \div 60$	11.9	4	M1 for $\sum fx$ with $x$ consistent within interval (including end points). Condone 1 error in multiplication M1 (dep) for use of midpoints condone 1 error. The first two M marks may be implied by 716 M1 (dep on first M1) for use of ' $\sum fx$ ' $\div 60$ A1 for 11.9 or 11.93... or 12 with working																

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Question	Working	Answer	Mark	Notes
14	$\frac{42}{250} \times 65$	11	2	M1 for $\frac{42}{250} \times 65$ or equivalent complete method A1 for 11
15 (a)	$\frac{310 + 324 + 346 + 302}{4} = 320.5$	320.5	2	M1 for $\frac{310 + 324 + 346 + 302}{4}$ A1 for cao
(b)		Upwards	1	B1 for upwards oe
(c)		111.8	2	M1 for $\frac{1282}{1147} \times 100$ A1 for 111.7-111.8
(d)		11.8% increase	1	B1 for 11.7%-11.8% and increase oe or ft their part (c)

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Question	Working	Answer	Mark	Notes
16 (a)		Complete probability tree diagram	2	B1 for correct probabilities on Sam's branches (0.94, 0.06) B1 for correct probabilities on Jes's branches (0.88, 0.12)
(b)(i)		0.8272	4	M1 for '0.94' × '0.88' A1 0.8272 oe
(ii)		0.1728		M1 for 1 – '0.8272' or 0.94×0.12+0.06×0.88+0.06×0.12 oe A1 for 0.1728 oe
17	$\frac{(40 \times 71.2) + (35 \times 63.4)}{75}$ $\frac{2848 + 2219}{75}$ $\frac{5067}{75}$	67.6	3	M1 for 40×71.2 (=2848) or 35×63.4 (=2219)  M1 for $\frac{'2848'+ '2219'}{75}$ or 5067÷75 A1 for 67.5-67.6

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Question	Working	Answer	Mark	Notes
18 (a)	$24 \times 25$	600	2	M1 for $24 \times 25$ A1 for cao
(b)	$\sqrt{\frac{14560}{25} - 24^2}$	2.53	3	M1 for $14560 \div 25$ M1 for $\frac{14560}{25} - 24^2$ or $\frac{14560}{25} - \left(\frac{600}{25}\right)^2$ A1 for 2.52-2.53



