Mark Scheme FINAL

January 2017

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If working is crossed out and still legible, then it should be given any appropriate marks, as long as it has not been replaced by alternative work.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

Question	Working	Answer	Mark	Notes
1 (a)		Correct reason	1	B1 for a correct reason from 1. It would be impossible to ask all the people in Wales who smoke. 2. Time consuming. 3. Too expensive. 4. Too much data to handle.
(b)		Correct answer	1	B1 for '**All** people in Wales (who smoke)'
(c)		Correct answer	1	B1 for a correct answer from 1. Use a survey/questionnaire 2. Interview method
2 (a)	<table><tr><td></td><td>4</td><td>779</td></tr><tr><td>652</td><td>5</td><td>023569</td></tr><tr><td>7764</td><td>6</td><td>2467</td></tr><tr><td>97630</td><td>7</td><td>02</td></tr><tr><td>632</td><td>8</td><td></td></tr></table> Key: 2|5 represents 52 (mph) 4|7 represents 47 (mph)	Stem & leaf and two keys	4	B3 for correct leaves for both (B2 for correct leaves for either Road A or Road B) (B1 for correct diagram with at most 2 errors in leaves) B1 for correct keys
(b)	<table><tr><td></td><td>Med</td><td>Mean</td><td>IQR</td><td>Range</td><td>Skew</td></tr><tr><td>Road A</td><td>70</td><td>70.2</td><td>15</td><td>34</td><td>Negative</td></tr><tr><td>Road B</td><td>56</td><td>57.9</td><td>16</td><td>25</td><td>Positive</td></tr></table>	2 comparisons	2	B2 ft for two comparisons from 1. Comparison of median/mean. 2. Comparison of IQR/Range. 3. Comparison of skew.

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Question	Working	Answer	Mark	Notes
3 (a)		Continuous	1	B1 for continuous
(b)	$\sum fx$ $=(1\times12)+(3\times21)+(5\times39)+(7\times18)$ $= 12+63+195+126 = 396$ $\dfrac{396}{90} = 4.4$	4.4	3	M1 for $\sum fx$ using midpoints (=396) (condone one error) M1 for '396' $\div$ 90 A1 for 4.4 oe
(c)		1.87	2	M1 for $\dfrac{2058}{90} - ('4.4')^2$ A1 for 1.87 Accept 1.9 with correct working
4 (a)		5	2	M1 for $\dfrac{25}{250} \times 50$ A1 for 5
(b)		1368	2	M1 for $\dfrac{38}{250} \times 9000$ A1 for 1368 or 1370

Question	Working	Answer	Mark	Notes
5 (a)		Complete probability tree diagram	2	B1 for correct probabilities on the first branches $(\frac{7}{10}, \frac{3}{10})$ oe B1 for correct probabilities on the second branches $(\frac{4}{9}, \frac{5}{9})$ oe
(b)		$\dfrac{28}{90}$	2	M1 for '$\frac{7}{10}$' $\times$ '$\frac{4}{9}$' A1 $\frac{28}{90}$ oe
(c)		$\dfrac{47}{90}$	3	M1 for ('$\frac{7}{10}$' $\times$ '$\frac{5}{9}$') **OR** ('$\frac{3}{10}$' $\times$ '$\frac{4}{9}$') oe M1 for ('$\frac{7}{10}$' $\times$ '$\frac{5}{9}$') + ('$\frac{3}{10}$' $\times$ '$\frac{4}{9}$') oe A1 for $\frac{47}{90}$ oe
6 (a)	See Appendix 1	5 8, 6, 7 14, 17, 18 15	4	B1 for 5 B1 for 8, 6, 7 B1 for 14, 17, 18 B1 for 15
(b)		$\dfrac{49}{90}$	2	M1 for ('14'+'17'+'18')/90 provided the numerator is less than 90 A1 for $\frac{49}{90}$ oe

Question	Working	Answer	Mark	Notes
7 (a)		104.1	2	M1 for $\frac{12850}{12345} \times 100$ A1 for 104.1
(b)		102.7	2	M1 for $\sqrt[4]{103.7 \times 101.8 \times 101.3 \times '104.1'}$ A1 For 102.7
(c)		2.7% increase	2	B1 for '2.7%' B1 for 'increase'
8 (a)		467	2	M1 for $(60/n) = (9/70)$ oe A1 for 466-467
(b)		assumption	1	B1 for correct assumption, e.g., n constant or random selection (of turtles) or paint not washed off oe
9	<table><tr><td></td><td>Med</td><td>IQR</td><td>Range</td><td>skew</td></tr><tr><td>East</td><td>35</td><td>23</td><td>47</td><td>+ve</td></tr><tr><td>West</td><td>46</td><td>29</td><td>54</td><td>-ve</td></tr></table>	3 comparisons	3	B3 for three comparisons from 1. Comparison of median eg Median of West Park is greater than East Park 2. Comparison of IQR/Range. eg IQR/Range of West Park is greater than the IQR/Range of East Park 3. Comparison of skew eg East Park has positive skew and West Park has negative skew

Question	Working	Answer	Mark	Notes
10		$\dfrac{102}{210}$	3	M1 for $\dfrac{9}{15} \times \dfrac{8}{14}$ **OR** $\dfrac{6}{15} \times \dfrac{5}{14}$ oe M1 for $\dfrac{9}{15} \times \dfrac{8}{14} + \dfrac{6}{15} \times \dfrac{5}{14}$ oe A1 for $\dfrac{102}{210}$ oe
11 (a)		Upwards	1	B1 for upwards oe
(b)		10 000	2	M1 for (10 (000) + 8 (000) + 12 (000))/3 A1 for 10 (000)
12 (a)		1.4	2	M1 for $\dfrac{\pm(67-60)}{5}$ A1 for 1.4
(b)		52.5	2	M1 for $-1.5 = \dfrac{\pm(x-60)}{5}$ A1 for 52.5
(c)		Kevin and correct reason	1	B1 for Kevin because his standardised score was higher.

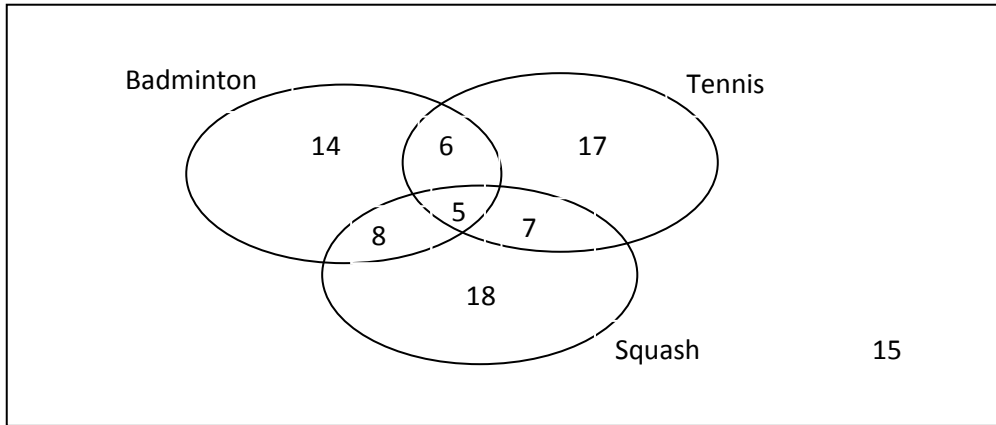| PAPER: AST30_01				
Question	Working	Answer	Mark	Notes
13 (a)		Reason	3	M1 for (IQR =) 53-35 = 18 seen M1 for using UQ + (1.5 × IQR) A1 85 > 80 oe
(b)	See Appendix 2	Correct box plot	3	M1 for box plot with any one value correct A1 for 3 or 4 correct values A1 for all 5 with outlier correctly shown
14 (i)		0.786	4	M1 for finding $\sum d^2$ must be a difference of ranks. Finding d^2 for at least 5 pairs and adding together. M1 for $r_s = 1 - \frac{6 \times '18'}{8(8^2-1)}$ A1 for 0.785-0.786 Accept 0.79 Accept 0.8 from correct working
(ii)		Some agreement with between the critics		A1 for 'some agreement with between the critics' oe Accept 'positive correlation' dependent on a sensible answer from (i)

Question	Working	Answer	Mark	Notes
15 (a)		0.599	2	M1 for $(1-0.05)^{10}$ A1 for 0.598-0.599 Accept 0.6 from correct working
(b)		0.914	2	M1 for part(a) + [10 x 0.05 x $(1-0.05)^9$] A1 for 0.913-0.914 Accept 0.91 from correct working
16 (a)		0.6554	2	M1 for $\pm\left(\frac{26.8-25.6}{3}\right) (=\pm0.4)$ A1 for 0.6554
(b)		0.2266	3	M1 for $\pm\left(\frac{27.85-25.6}{3}\right) (=\pm0.75)$ M1 for $1-P\left(z<\frac{27.85-25.6}{3}\right)$ A1 for 0.2266
17 (a)	$\sum x = 143$ $\sum y = 293$	−0.817	4	M1 for $3585 - \frac{'143' \times '293'}{10} (=-604.9)$ M1 for correct use of $r = \frac{S_{xy}}{\sqrt{S_{xx}\times S_{yy}}} \left(= \frac{'-604.9'}{\sqrt{718.1\times764.1}}\right)$ M1 for $\frac{-604.9}{\sqrt{718.1\times764.1}}$ A1 for −0.817 Accept − 0.82
(b)(i)		Negative	2	B1 for 'negative'
(ii)		Correct interpretation		B1 for 'as the selling price increases the number of sales decreases' oe

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Question		Working	Answer	Mark	Notes
18	(a)		$\dfrac{1}{3}$	1	B1 for $\frac{1}{3}$ oe
	(b)		$\dfrac{4}{15}$	1	B1 for $\frac{4}{15}$ oe
	(c)		$\dfrac{13}{15}$	2	M1 for $\frac{1}{3} + \frac{4}{5} - \frac{'4'}{15}$ oe A1 for $\frac{13}{15}$ oe
19	(a)		Two correct normal distribution curves drawn	4	B1 for 2 bell shaped curves drawn and labelled salmon and trout B1 for a bell shaped curve starting at 63 and ending at 81 B1 for a bell shaped curve starting at 45 and ending at 75 B1(dep on 1$^{\text{st}}$ B1) for salmon curve taller than trout curve
	(b)		Two correct comparisons	2	B1 for a comparison of average B1 for a comparison of spread

Appendix 1

Badminton

Tennis

14   6   17

5

8   7

18

Squash   15

Appendix 2

20   30   40   50   60   70   80   90

Length (cm)