Cambridge Assessment International Education

Cambridge O Level

STATISTICS **4040/23**

Paper 2 **October/November 2023**

MARK SCHEME

Maximum Mark: 100

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the October/November 2023 series for most Cambridge IGCSE, Cambridge International A and AS Level components, and some Cambridge O Level components.

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

MARK SCHEME NOTES

The following notes are intended to aid interpretation of mark schemes in general, but individual mark schemes may include marks awarded for specific reasons outside the scope of these notes.

Types of mark

M Method marks, awarded for a valid method applied to the problem.

A Accuracy mark, awarded for a correct answer or intermediate step correctly obtained. For accuracy marks to be given, the associated Method mark must be earned or implied.

B Mark for a correct result or statement independent of Method marks.

When a part of a question has two or more 'method' steps, the M marks are in principle independent unless the scheme specifically says otherwise; and similarly where there are several B marks allocated. The notation 'dep' is used to indicate that a particular M or B mark is dependent on an earlier, asterisked, mark in the scheme.

The symbol √ implies that the A or B mark indicated is allowed for work correctly following on from previously incorrect results. Otherwise, A and B marks are given for correct work only.

Abbreviations

AG answer given on question paper
awrt answer which rounds to
cao correct answer only
dep dependent
ft follow through after error
oe or equivalent
SC special case
soi seen or implied
www without wrong working

Question	Answer	Marks	Partial Marks
1(a)	$(x – 50)/12 = (41 – 60.5)/7.8$ **oe**	**2**	M1
	20		A1
1(b)	$(40 – 37.2)/y = (54 – 50)/12$ **oe**	**2**	M1
	8.4		A1
1(c)	$(x – 60.5)/7.8 = (x – 50)/12$ **oe**	**2**	M1
	80		A1

Question	Answer	Marks	Partial Marks
2(a)	2/5 **oe**	**1**	B1
2(b)	Use of $P(A \cap B) = P(A) \times P(B)$ $3/5 \times 1/2$	**2**	M1
	3/10 **oe**		A1
2(c)	Use of $P(A \cup B) = P(A) + P(B) – P(A \cap B)$ 3/5 + 1/2 – '3/10'	**2**	M1
	4/5 **oe**		A1
2(d)	*A* and *A*' because they cannot both happen together	**1**	B1

Question	Answer	Marks	Partial Marks
3(a)	0187 – 0127 (= 60)	**2**	M1
	1200/60 = 20		A1
3(b)(i)	$36/84 \times 7$ or $12/84 \times 7$	**2**	M1
	3, 3 and 1		A1
3(b)(ii)	79 04 41 23 35 58 60 (***B2*** *for 1 error/omission*) (***B1*** *for 2 errors/omissions*)	**3**	B3

Question	Answer	Marks	Partial Marks
4(a)	Red foxes have generally smaller paw lengths **oe** or Coyotes have generally larger paw prints **oe**	**2**	B1
	Red foxes have less varied paw lengths **oe** or Coyotes have more varied paw lengths **oe**		B1
4(b)	Frequency polygons can be displayed together/allow easy comparison **oe**	**1**	B1
4(c)	Correct and none of the red foxes paw prints were between 7 and 8 cm or none were more than 7 cm or all were less than 7 cm **oe**	**1**	B1

Question	Answer	Marks	Partial Marks
5(a)	Fig. 1: The vertical axis does not start at 0	**2**	B1
	Fig. 2: The scale is not linear		B1
5(b)	$8300	**1**	B1
5(c)	A box and whisker diagram with a linear scale	**4**	M1
	Linear scale from at least 7[000] to 12[000] with labelling including 'salary', '$', and 'thousands' if appropriate		A1
	Lowest = 7100 LQ = 7800 Median = '8300' UQ = 9300 Highest = 11 900 (***B1ft*** *for 3 or 4 correct*)		B2ft

Question	Answer	Marks	Partial Marks
6(a)	Correct method: $[0 \times 6] + 1 \times 9 + 2 \times 10 + 3 \times 5$	**2**	M1
	44		A1

Question	Answer	Marks	Partial Marks
6(b)	20/44 × 1/43 + 15/44 × 2/43 20 **and** 15 (× 2) in each of two numerators	**5**	M1
	20/44 **or** 15/44 in a product		M1
	$n(n-1)$ in at least one denominator		M1
	44 × 43 in all denominators		M1
	25/946 **oe**		A1

Question	Answer	Marks	Partial Marks
7(a)	Continuous quantitative	**2**	B1 B1
7(b)	90th value	**5**	B1
	55 +		M1
	'24'/42 × 5		M1
	or		
	60 –		(M1
	'18'/42 × 5		M1)
	or		
	(55 × '18' + 60 × '24')/42		(M2)
	'57.86' – 50.26		M1
	IQR = 7.6		A1
7(c)	Mean likely to be less than median due to some extreme **low** times **oe**	**1**	B1

Question	Answer	Marks	Partial Marks
7(d)	8/10 × 15 [= 12] **oe**	**3**	M1
	'8/10' × 15 + 13		M1
	or		
	2/10 × 15 [= 3] **oe**		(M1
	(15 – '2/10' × 15) + 13		M1)
	or		
	(13 × 2 + 28 × 8)/10		(M2)
	25		A1
7(e)	Median = 51.71 and IQR = '7.6'	**1**	B1ft
7(f)	48 + 2.5 (= 50.5) or 50 – 2.5 (= 47.5)	**4**	M1
	0.5/5 × 38 + 13 + 15 (= 31.8) **oe**		M1
	'0.5/5' × 38 + 13 + 15 – '25' (= 6.8)		M1
	7		A1

Question	Answer	Marks	Partial Marks
8(a)	[Maintenance =] 40 × 24 000 ÷ 1000 (= 960)	**3**	M1
	[Fuel =] 1.25 × 7.2 × 24000 ÷ 100 (= 2160)		M1
	720 : 960 : 2160 leading to 3 : 4 : 9 **AG** **or** 720/240 = 3, 960/240 = 4, 2160/240 = 9 leading to 3 : 4 : 9 **AG**		A1
8(b)	Appropriate linear scale labelled % and key or labelled bars	**3**	B1
	3/(3 + 4 + 9) × 100 **or** 4/(3 + 4 + 9) × 100 **or** 9/(3 + 4 + 9) × 100 **oe**		M1
	Bars all correct: T&I 18.75; Maintenance 25; Fuel 56.25.		A1
8(c)	Decreased because weight for fuel is over 50% **and** decrease in fuel (8%) is greater than the two increases/greater than the combined increase (***B1*** *for decreased because weight for fuel is over 50%* ***or for*** *decreased because decrease in fuel (8%) is greater than the two increases/greater than the combined increase*)	**2**	B2

Question	Answer	Marks	Partial Marks
8(d)	2018: all 100	**4**	B1
	2022: Tax and insurance = 84		B1
	36/40 [× 100] **oe or** 1.45/1.25 [× 100] **oe**		M1
	Maintenance = 90 **and** Fuel = 116		A1
8(e)	'84' × 3 + '90' × 4 + '116' × 9	**3**	M1*
	÷ (3 + 4 + 9) **dep**		M1dep
	103.5		A1
8(f)	Fuel consumption of new car might be different/distance travelled may have changed/amount of fuel may have changed **oe**	**1**	B1

Question	Answer	Marks	Partial Marks
9(a)	Correct plots	**2**	B1
	Joined with straight line segments		B1
9(b)	An explanation suggesting that she has not considered all the data/she has only considered the last three data points	**1**	B1

Question	Answer	Marks	Partial Marks
9(c)		**7**	

Time	Reading	3-pt total	3-pt moving average
1	103		
2	70	238	79.3
3	65	233	77.7
4	98	231	77
5	68	228	76
6	62	228	76
7	98	225	75
8	65	222	74
9	59	219	73
10	95	216	72
11	62	213	71
12	56		

A moving average calculation (even if not 3-pt)	M1
A 3-pt or 6-pt total or 3-pt or 6-pt moving average calculation	M1
At least 4 correct 3-pt moving average values	A1
All 10 correct moving average values	A1
Correct plots vertically for 3-pt or 6-pt moving average values	B1
10 correct plots horizontally	B1
An appropriate trend line	B1ft

Question	Answer	Marks	Partial Marks
9(d)	(±) at least one appropriate difference at (t = 1), t = 4, t = 7, and t = 10 Using the table, these appropriate differences are: t = 4, difference = (±)(98 – '77') = (±)21 t = 7, difference = (±)(98 – '75') = (±)23 t = 10, difference = (±)(95 – '72') = (±)23 Using the graph, these appropriate differences are: t = 1, difference ≈ (±)(103 – '80') = (±)23 t = 4, difference ≈ (±)(98 – '77') = (±)21 t = 7, difference ≈ (±)(98 – '75') = (±)23 t = 10, difference ≈ (±)(95 – '72') = (±)23	**5**	M1
	All 3 appropriate differences above from table (and no others) **or** All 4 appropriate differences above from graph (and no others)		M1
	Sum of (±) *their* differences ÷ *n*, where *n* = 3 or 4. ('21' + '23' + '23') ÷ 3 [= 22.3] or ('23' + '21' + '23' + '23') ÷ 4 [= 22.5]		M1
	Their trend line reading at T = 13 + *their* seasonal component '70' + '22.3'		M1
	92		A1

Question	Answer	Marks	Partial Marks
10(a)(i)	[P(not 4) =] 3/4	**2**	M1
	3/4 × 3/4 × 3/4 = 27/64 **oe**		A1
10(a)(ii)	3/4 × 3/4 × 1/4	**2**	M1
	9/64 **oe**		A1
10(b)(i)	'27/64' + '9/64' = 9/16 **oe**	**1**	B1ft
10(b)(ii)	1/4 × 1/4 × 1/4 = 1/64 **oe**	**1**	B1
10(b)(iii)	4 3 4 and 4 4 3 **soi**	**2**	M1
	1/4 × 1/4 × 1/4 × 2 = 1/32 **oe**		A1

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Partial Marks</th></tr>
<tr><td rowspan="4">10(c)</td><td><table><tr><td>[Prize]</td><td>0</td><td>1</td><td>2</td><td>3</td></tr><tr><td>[Probability]</td><td>36/64</td><td>25/64</td><td>2/64</td><td>1/64</td></tr></table></td><td rowspan="4">3</td><td></td></tr>
<tr><td>Table with prizes of 0, 1, 2 and 3 and probabilities</td><td>B1</td></tr>
<tr><td>Four probabilities that sum to 1 or correct P(1)</td><td>M1</td></tr>
<tr><td>Fully correct probabilities</td><td>A1</td></tr>
<tr><td rowspan="2">10(d)</td><td>[0 × ‘36/64’] + ‘1’ × ‘25/64’ + ‘2’ × ‘2/64’ + ‘3’ × ‘1/64’
Σ’prize’ × ’probability’</td><td rowspan="2">2</td><td>M1</td></tr>
<tr><td>$0.50</td><td>A1</td></tr>
<tr><td rowspan="2">10(e)</td><td>[0 × ‘36/64’] + 1 × ‘25/64’ + 2 × ‘2/64’ + x × ‘1/64’ = 2 × ‘0.5’</td><td rowspan="2">2</td><td>M1</td></tr>
<tr><td>$35</td><td>A1</td></tr>
<tr><td>10(f)</td><td>The probability of ending up on square 8 is very small, so a small increase in the amount charged results in a large increase of that prize</td><td>1</td><td>B1</td></tr>
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