Cambridge O Level

STATISTICS **4040/12**

Paper 1 **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.

This document consists of **9** printed pages.

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)	Quota	**1**	B1
1(b)	Systematic	**1**	B1
1(c)	Stratified	**1**	B1
1(d)	Random	**1**	B1

Question	Answer	Marks	Partial Marks
2(a)(i)	2	**1**	B1
2(a)(ii)	Order data	**2**	M1
	4		A1
2(a)(iii)	7	**1**	A1
2(b)	Not central/not in the middle/at one end of the distribution/smallest	**1**	B1
2(c)	Upper quartile 7.5	**1**	B1

Question	Answer	Marks	Partial Marks
3(a)	(40/360) × 100	**2**	M1
	11.1 [%]		A1
3(b)	[(360 – 170)/360] × 100 **oe**	**2**	M1
	52.8 [%]		A1
3(c)	r^2 seen in an equation	**3**	M1
	correct use of r^2 $3/1 = r^2/4^2$ **oe**		M1
	6.9 cm		A1

Question	Answer	Marks	Partial Marks
4(a)	Two-way table with rows/columns headed S(un), C(loud), R(ain) and columns/rows headed M(orning), A(fternoon), E(vening)	**4**	M1
	cell values 6, 10, 4 12, 3, 5 14, 2, 4 in correct places totals not required *(Allow A2 for seven or eight correct, Allow A1 for five or six correct, or no values but fully correct tallies, Allow B1 for no table but fully correct category values stated MS = 6, MC = 10 etc.)*		A3
4(b)	B1 for each of any two accurate observations, e.g. • cloud most common in the morning • cloud quite rare in the evening • sun most common overall • rain evenly distributed b/w morning, afternoon, evening	**2**	B2
4(c)	Any relevant observation, e.g. • first four days no rain • continuous rain on three consecutive days • after very rainy period five days with no rain • was sunny all day on four days • it was never cloudy all day	**1**	B1

Question	Answer	Marks	Partial Marks
5(a)	Column with height 14, width 1, in correct place	**5**	B1
	Indication of area being proportional to class frequency		M1
	Column heights 4, 18, 5 *(allow A1 for two correct)*		A2
	Fully correct diagram		A1
5(b)	Indication of use of class mid-points	**3**	M1*
	$6 \times 1.75 + 11 \times 3 + 9 \times 3.75 + 14 \times 4.5 + 10 \times 6$ **dep** $(= 10.5 + 33 + 33.75 + 63 + 60)$		M1dep
	200.25		A1

Question	Answer	Marks	Partial Marks
6(a)(i)	$0.9^3 \times 0.9 \times 0.1$	**2**	M1
	0.0656		A1

Question	Answer	Marks	Partial Marks
6(a)(ii)	0.9^2 or 0.9^4 seen	**3**	M1
	$0.9^2 \times 0.1 \times 3 \times 0.9^2$		M1
	0.197		A1
6(b)	$0.9^3 \times 0.75^3$	**2**	M1
	0.308		A1

Question	Answer	Marks	Partial Marks
7(a)	[(250 + 300 + 350 + 400)/4, (254 + 266 + 273 + 279)/4]	**2**	M1
	(325, 268)		A1
7(b)	m use $(y_2 - y_1)/(x_2 - x_1)$ with any pair of averages	**3**	M1
	c use $y = mx + c$ with any average and *their m*		M1
	$m = 0.27$ **and** $c = 180.25$		A1
7(c)(i)	**ft** *their c*	**1**	B1√
7(c)(ii)	Put $x = 600$ in *their* LOBF with positive gradient and find y	**2**	M1
	342[cm] **ft**		A1√
7(d)	Correctly plotted points *(allow B1 for 6 or 7 correct)*	**2**	B2
7(e)	Plot at least two points accurately for drawing line e.g. (0, 180), (200, 234), (400, 288) **ft** *their* line	**2**	M1
	Straight line, from $x = 0$ to $x = 400$, joining their points **ft**		A1√
7(f)	Plotted points indicate a (slightly) non-linear relationship / Rate of growth decreases with time/points follow a curve	**1**	B1
7(g)	Smaller than value calculated from line of best fit	**1**	B1

Question	Answer	Marks	Partial Marks
8(a)	(8/1875) × 1000 [=4.266…]	**1**	B1
8(b)	(1/625) × 1000 **oe** for any group	**3**	M1
	1.6 4[.0] 8[.0] *(allow A1 for any two correct)*		A2

Question	Answer	Marks	Partial Marks
8(c)	Any group rate multiplied by standard population figure	**3**	M1
	(*their* 1.6 × 0.30) + (*their* 4.0 × 0.50) + (*their* 8.0 × 0.2) **oe**		M1
	4.08 or 4.1		A1
8(d)(i)	(1540/1000) × 8.4 **oe** for any striker implied by 13, 14, 11 or 12	**2**	M1
	Benjani 14		A1
8(d)(ii)	Camara 11	**1**	A1
8(e)	Because his standardised rate highest/largest	**2**	M1
	Alonso		A1
8(f)	Product of probability fractions with denominators 4, 3 seen	**3**	M1
	(1/4) × (1/3) × 2 [× 1 × 1]		M1
	1/6		A1

Question	Answer	Marks	Partial Marks
9(a)(i)	3.5	**1**	B1
9(a)(ii)	Q3: find dissolved O_2 for cf = 57 (= 4.40 – 4.45)	**3**	M1
	Use IQR = Q3 – 2.6		M1
	1.80 – 1.85 **www**		A1
9(a)(iii)	Find dissolved O_2 for cf = 0.35 × 76 (cf = 26.6 ≈ 26 or 27)	**2**	M1
	3.00 – 3.05 **www**		A1
9(b)(i)	[(76 – 71)/76] × 100	**2**	M1
	6.58 [%]		A1
9(b)(ii)	Find dissolved O_2 for cf = 50 + 0.50 × (71 – 50) (cf = 60.5)	**2**	M1
	4.68 – 4.75 **www**		A1

Question	Answer	Marks	Partial Marks
9(c)(i)	Find cf for dissolved O_2 =4.0 (=50)	**2**	M1
	$(50/76) \times 100 = 65.8$ [%]		A1
	or		
	Find dissolved O_2 for cf = 0.30 $\times$ 76 (cf = 22.8 $\approx$ 23)		(M1
	2.80 – 2.85 **www**		A1)
9(c)(ii)	Find cf for dissolved O_2 = 2.5 (= 17 – 18)	**2**	M1
	$((17–18)/76) \times 100 = 22.3$ [%] – 23.7 [%] < 30 [%] No further action		A1
	or		
	Find dissolved O_2 for cf = 0.30 $\times$ 76 (cf = 22.8 $\approx$ 23)		(M1
	(2.80 – 2.85) + 1.5 = 4.30 – 4.35 > 4.0 No further action		A1)
9(d)	Indication of using a daily sample size > 1	**2**	B1
	Indication of how larger sample taken/used, e.g. • mean of more than one calculated • measurements taken at different times of day • measurements taken at different places on the river		B1

Question	Answer	Marks	Partial Marks
10(a)	16 [hours]	**1**	B1
10(b)	Find values of $f \times x$ ($\Sigma fx = 480$)	**6**	M1
	Use $(\Sigma fx)/\Sigma f$		M1
	Find values of $f \times x^2$ ($\Sigma fx^2 = 6050$)		M1
	Use $(\Sigma fx^2)/\Sigma f - [(\Sigma fx)/\Sigma f]^2$ with/without root		M1
	10.6 – 10.7 **and** 4.4 – 4.6 **www**		A1
	10.7 **and** 4.55 [hours]		A1
10(c)(i)	Education mean largest	**1**	B1
10(c)(ii)	History standard deviation smallest	**1**	B1

Question	Answer	Marks	Partial Marks
10(c)(iii)	Languages difference between mean and median largest/ mean [most] affected by extreme[ly large] values *(if zero scored in all three parts, allow SC1 for Education, History, Languages only)*	1	B1
10(d)(i)	86	1	B1
10(d)(ii)	141	1	B1
10(d)(iii)	56	1	B1
10(e)	Find total number of registrations $[(29 + 48 + 37)] \times 1 + [\textit{their } 56] \times 2 + [8] \times 3$ **or** $(29 + 22 + 8 + 15) + (15 + 8 + 19 + 48)$ $+ (22+37+19+8) \ (= 250)$	3	M1
	Their 250/*their* total number of people (= 250/178)		M1
	1.40 or 1.4		A1