



Cambridge International Examinations
Cambridge Ordinary Level

STATISTICS

4040/13

Paper 1

October/November 2016

MARK SCHEME

Maximum Mark: 100

Published

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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

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- 1 (i) carbohydrates 198° proteins 54° fats 108°
(allow B1 for one correct) B2
- (ii) chart of radius 4 cm (± 1 mm) with three sectors labelled B1
their sector angles correct ($\pm 2^\circ$) with correct labels B1✓
[4]
- 2 (i) 0, 3 in correct place B1
(ii) 8, 12 in correct place B1
35 in correct place B1✓
(iii) 40 in correct place B1
10, 29 or 10, 6 in correct place B1✓
fully correct table B1
[6]
- 3 (i) correct method for mean *of d values*
($d = 12, 4, -4, -7, -1, 0, 10$ $\Sigma d = 14$) M1
mean = 1002 A1
correct method for SD or variance *of d values*
($\Sigma d^2 = 326$) M1
SD = 6.52 or 6.52 ... A1
(ii) mean = their 1002 – 80 (= 922) B1✓
range = 19 B1
[6]
- 4 (i) 17 B1
(ii) 19 B1
(iii) correct method (e.g. $11 + 7 + 8 + 5 + 1 + 3$) M1
35 A1
(iv) 9 B1
(v) 11 B1
[6]

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- 5** (i) $3/87$ or $1/29$ B1
- (ii) $64/87$ B1
- (iii) $69/84$ or $23/28$ B1
- (iv) $(84/87) \times (3/86)$ M1
- $\times 2$ M1
- $504/7482$ or $252/3741$ or $84/1247$ A1
- [6]
- 6** (i) indication of appropriate method
by finding total of passengers boarding or alighting
(e.g. $27 + 4 + 14 + 7 + 2$) M1
- 54 A1
- (ii) indication of appropriate method
by finding numbers travelling between stops
(27, 27, 30, 25, 34, 34, 37, 39, 30)
implied by one correct answer M1
- 25 A1
- 39 A1
- (iii) (a) comfort B1
- (b) cost B1
- (c) punctuality B1
- [8]
- 7** (i) $48 + 68 + 20 + 11$ (=147) M1
- $48 + 80 + 32 + 20$ (=180) M1
- correct expression seen leading to given answer
 $(147/180) \times 100$ A1
- 81.7% AG
- (ii) correct method for very good, good or moderate group M1
- 100 85 62.5 55 A1

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	(iii) any one of very good, good or moderate group rate multiplied by standard population figure	M1
	sum of four such products	M1
	$(100 \times 0.20) + (85 \times 0.35) + (62.5 \times 0.30) + (55 \times 0.15)$	A1✓
	76.75% or 76.8%	A1
	(iv) $(45 \times 1) + (78 \times 0.833) + (44 \times 0.659) + (33 \times 0.606)$ (=159)	M1
	$((\text{their } 159)/(45 + 78 + 44 + 33)) \times 100$ (=159/2)	M1
	79.5%	A1
	(v) $(100 \times 0.20) + (83.3 \times 0.35) + (65.9 \times 0.30) + (60.6 \times 0.15)$	M1
	78.0%	A1
	(vi) higher standardised pass rate/ achieves greater success with less able students	M1
8	Hale	A1✓
		[16]
	(i) attempted use of class mid-points (17, 19, 21, 23, 26)	M1*
	correct method for mean ($\Sigma fx = 1277$)	M1dep
	21 or 21.2 or 21.3 or 21.28 ...	A1
	finding values of $f \times \text{variable squared}$ (e.g. 1445, 5054 ...)	M1
	correct method for SD or variance ($\Sigma fx^2 = 27545$)	M1dep
	2.5 or 2.47 – 2.50	A1
	21.3 and 2.47	A1
	(ii) 8, 17 in correct place	B1
	any indication of column area being proportional to frequency implied by any one correct answer for three non-standard width classes	M1
	4, 21, 10	A3

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	(iii) their $4 \times 26 + \text{their } 8 \times 29 + \text{their } 17 \times 31 + \text{their } 21 \times 33.5 + \text{their } 10 \times 37.5 (=1941.5)$	M1
	their $1277 + \text{their } 1941.5 (=3218.5)$	M1
	their $3218.5/60$ with $\Sigma f = 60$ from (ii)	M1
	54	
	ft only on their 1277	A1✓
		[16]
9	(i) 4, 15, 35, 60, 74, 80	B1
	(ii) horizontal plots at UCBs	B1
	their vertical plots at cfs	M1
	suitable curve	A1
	(iii) (a) 355 – 362.5 (litres)	B1
	(b) Q1 find consumption for cf = 20 (312 – 317 (litres))	M1
	Q3 find consumption for cf = 60 (400 (litres))	M1
	use of IQR = Q3 – Q1	
	with at least one of Q1, Q3 found properly from their curve	M1
	83 – 88 (litres)	A1
	(c) attempt to find cf at 375 litres (48) as a percentage of 80	M1
	58.75 – 61.25	A1
	(iv) $1 - (\text{their (iii)(c)})/100$	B1✓
	(v) their median $\times 80$ ($360 \times 80 = 28800$)	M1
	their $28800/1000$ ($=28.8$)	M1
	(their $28.8 \times \$2.50$) + ($80 \times \0.25)	M1
	\$92	A1✓
		[16]
10	(i) 15 000	B1
	(ii) $15 \times 2500 - 5 \times 2500$	M1
	25 000	A1

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(iii) $[(15 \times 2500 - 13 \times 2500)/(13 \times 2500)] \times 100$ oe M1

15% or 15.4% or 15.38 ...% A1

(iv) (a) $3/6$ B1

(b) $3/6$ B1

(c) $3/5$ B1

(v) find decrease
 for total $15000 - 12500$ (=2500) or
 for Com $0.3 \times (15000 - 12500)$ (=4500 – 3750 = 750) or
 for others $0.7 \times (15000 - 12500)$ (=10500 – 8750 = 1750) M1

find appropriate fraction
 2500×0.14 or $(2500 - 750) \times 0.2$ or 1750×0.2 M1

350 A1

(vi) $0.3 (\times 1) + 0.7 \times (4/5)$ M1

0.86 A1

(vii) $(0.3)^3 (\times 1)$ B1

$+ (0.14)^3 \times 2$ M1

0.032 or 0.0325 or 0.0324 ... A1

[16]

11 (i) correctly plotted points
 (allow B1 for 6 or 7 correct) B2

(ii) correct method for USA M1

(6.5, 62) plotted correctly A1

(4.5, 79) and (2.5, 96) plotted correctly B1

(iii) line through at least two of their plotted averages B1

correct method for gradient M1

correct method for c M1

$m = -8.60$ to -8.40 and $c = 116$ to 118 A1

(iv) setting $y = 0$ in their equation, solving for x (and subtracting 8) M1

6 (accept decimal answer 5.8) A1✓

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- (v) (substantial) extrapolation beyond range of data/
relationship established may change/
relationship may become non linear
(do not accept references to relapsing alone) B1
- (vi) (a) any indication that c only is determining factor M1
- George: highest c, highest y at the start where $x=0$
ft conclusion from their equation for Alfred A1✓
- (b) any indication that m only is determining factor M1
- Joseph: *magnitude* of m is largest, steepest negative gradient
ft conclusion from their equation for Alfred A1✓
- [16]