
STATISTICS

4040/13

Paper 1

October/November 2019

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.

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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)	40	1	B1
1(b)	35	1	B1
1(c)	$(40/(60 + 25 + 40)) \times 100$ or $(8/(12 + 5 + 8)) \times 100$	2	M1
	32 [%]		A1

Question	Answer	Marks	Partial Marks
2(a)	numerical ordering of data	2	M1
	7.5		A1
2(b)	10	1	B1
2(c)	yes – e.g. most common occupancy is maximum, and some visitors may have had to park elsewhere / no – e.g., half of the time 7 or fewer spaces occupied, so at least half of the time provision is adequate	1	B1

Question	Answer	Marks	Partial Marks
3(a)	as the value of one variable increases the value of the other decreases / variables inversely proportional	1	B1
3(b)	A positive and B negative	4	B1
	A weak		B1
	B strong		B1
	C no correlation		B1

Question	Answer	Marks	Partial Marks
4(a)	24, 24 in correct places	1	B1
4(b)	12, 16 in correct places	1	B1
4(c)	7, 5 in correct places	2	B1
	5, 3, 15, 21 in correct places correct completion ft		B1✓

Question	Answer	Marks	Partial Marks
4(d)	$((\text{their } 15 \times 3) + (12 \times 1))/48$	2	M1
	1.19 and no ft		A1✓

Question	Answer	Marks	Partial Marks
5(a)	9	1	B1
5(b)	38	1	B1
5(c)	labelled diagram with A only 3, C only 2, M only 1	3	B1
	A and C only 2, A and M only 1, C and M only 4		B1
	A and C and M 2		B1
	<i>(unlabelled, allow SC1 for triple intersection only)</i>		
5(d)	5 ft	1	B1✓

Question	Answer	Marks	Partial Marks
6(a)(i)	in A all parents have an opportunity to reply, in C those without web access do not	1	B1
6(a)(ii)	in B follow up questions can be asked / discussion can take place, but not in A / postal services unreliable	1	B1
6(a)(iii)	in C cheaper/quicker / not all parents have telephone but use public internet facilities / potentially targets more parents / data more readily analysed / lacks pressure in responding	1	B1
6(b)	any question which by its nature has a limited number of possible responses	2	B1
	limited responses provided		B1
	<i>(allow SC1 for closed question, with responses provided, but not appropriate for survey)</i>		
6(c)	teachers, population smallest, so all population can be consulted most readily	1	B1

Question	Answer	Marks	Partial Marks
7(a)	$340 + 180 + 220 + 90 (= 830)$	4	M1
	$6200 + 1300 + 2800 + 5900 (= 16200)$		M1
	$(\text{their } 830/\text{their } 16200) \times 1000$		M1
	51.2		A1
7(b)	$16200 \times 2 (= 32400)$	4	M1
	$(\text{their } 32400/1000) \times 8.7 (= 282)$		M1
	$\text{their } 830 - \text{their } 282$		M1
	548		A1

Question	Answer	Marks	Partial Marks
8(a)	47, 64, 84, 126, 135, 138, 140	1	B1
8(b)	horizontal plots at UCBs	3	B1
	vertical plots of cfs		M1
	ruled straight lines joining 7 plotted points		A1
8(c)(i)	11.5	1	B1
8(c)(ii)	[Q3] find speed for cf = 105 (= 17.5)	3	M1
	use of IQR = Q3 – Q1		M1
	13.8		A1
8(d)	A find cf for speed = 7 (= 54) and subtract from 140 (= 86)	5	M1
	find 60% of 140 (= 84) and compare with <i>their</i> 86 or express <i>their</i> 86 as a percentage of 140 (= 61.4%) and compare with 60%		M1
	correct working and A yes		A1
	B find cf for speed = 22.5 (= 130) and subtract from 140 (= 10) find 10% of 140 (= 14) and compare with <i>their</i> 10 or express <i>their</i> 10 as a percentage of 140 (= 7.14%) and compare with 10%		M1
	correct working and B no		A1

Question	Answer	Marks	Partial Marks
8(e)	the linear interpolation method assumes a straight line connection between the points in a cf distribution, exactly the same as in the cf polygon which has been drawn	1	B1

Question	Answer	Marks	Partial Marks
9(a)(i)	any indication of column area being proportional to frequency	2	M1
	6		A1
9(a)(ii)	21	1	A1
9(a)(iii)	24	1	A1
9(b)(i)	0.4^2	2	M1
	0.16 or $4/25$		A1
9(b)(ii)	0.4×0.6	3	M1
	$\times 2$		M1
	0.48 or $12/25$		A1
9(c)(i)	0.24^2 or 0.09^2	3	B1
	$0.24^2 + 0.09^2$		M1
	0.0657		A1
9(c)(ii)	0.91 seen or $(0.09)^2$ not as part of another product	3	B1
	$1 - 0.91^2$		M1
	0.172		A1

Question	Answer	Marks	Partial Marks
10(a)	correctly plotted points <i>(allow B1 for 6 or 7 correct)</i>	2	B2
10(b)	3, there are not two different routes with exactly the same distance/cannot tell because there may be two or more routes with exactly the same distance	1	B1
10(c)	6, he only goes jogging at most once every day/cannot tell because he could go jogging more than once on any day	1	B1

Question	Answer	Marks	Partial Marks
10(d)	method for LSA	3	M1
	plot of (4.5, 30)		A1
	plot of (5.7, 37) and (6.9, 44)		B1
10(e)	line through at least two of <i>their</i> plots in (d)	4	B1
	correct method for gradient		M1
	correct method for c		M1
	$m = 5.83$ and $c = 3.75 - 3.775$, 3.0 – 4.0 if clearly from graph		A1
10(f)	use $x = 10$ in <i>their</i> equation and find y (= 62.05)	3	M1
	<i>their</i> 62.05/3.5		M1
	17 ft		A1 [✓]
10(g)	extrapolation beyond range of collected data may not be valid for LOBF	2	B1
	individual points scatter considerably around LOBF, so on any one occasion jogging time may deviate considerably from predicted LOBF time or songs lengths are likely to vary		B1
	(B1 for each valid reason)		

Question	Answer	Marks	Partial Marks
11(a)	$(90/360) \times 5400$	2	M1
	1350		A1
11(b)	use of r^2 to find 2018 total	4	M1
	$5400 \times (3^2/2.5^2)$ (= 7776)		M1
	$(200/360) \times$ <i>their</i> 7776		M1
	4320		A1

Question	Answer	Marks	Partial Marks
11(c)	80 – 45 (= 35) or 76 – 50 (= 26)	4	M1
	<i>(their 35/100) × 5400 (= 1890)</i> or <i>(their 26/100) × their 7776 (= 2021.76)</i>		M1
	<i>their 2021.76 – their 1890</i>		M1
	132 increase		A1
11(d)	$(30/360) \times 5400 \times (68/100) (= 306)$	4	M1
	$(45/100) \times 5400 (= 2430)$		M1
	$(\textit{their 306}/\textit{their 2430}) \times 100$		M1
	12.6 [%]		A1
11(e)	<p>answers indicating understanding that individual flowers in the bunch will live for different times, with valid judgement based on both mean and range</p> <p>e.g. choice A smallest mean, but smallest range indicates flowers dying first will last longer than flowers in any other variety</p> <p>e.g. choice B mean is largest and together with largest range indicates <i>some</i> flowers in bunch will last longer than flowers in any other variety.</p> <p>e.g. choice A all varieties have about the same mean life, but smallest range indicates that all the flowers in the bunch will last for about the same time as each other</p> <p><i>allow B1 for answers indicating understanding that flowers in the bunch will live for different times based on only mean, or only on range</i> or <i>answers with valid judgement based on mean and range</i></p> <p>eg choice B B has the largest mean so generally/on average/usually this variety lasts longest</p>	2	B2
<i>if B0 allow M1 for any one or more of</i> 9.7, 11.7, 9.1, 13.1, 9.4, 12.4 seen			