



Cambridge International Examinations
Cambridge Ordinary Level

STATISTICS

4040/22

Paper 2

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) B and E **B1**
- (ii) C **B1**
- (iii) A (the colour of each car) is not quantitative/is qualitative **oe** **B1**
D (the height of each car) is not discrete/is continuous **oe** **B1**
- 2 (i) Use of $P(A \cap B) = P(A) + P(B) - P(A \cup B)$ **M1**
 $= 0.8 + 0.7 - 0.9$
 $= 0.6$ **A1**
- The probability of A and B/the probability of both/the probability of A intersection B **B1**
- (ii) [The probability of] A **or** B but not both/A only **or** B only **B1**
- (iii) C and D are mutually exclusive events **oe** **B1**
- 3 (i) $(53 - 59.2)/9.3 = (x - 50)/15$ **oe**
 $(67 - 74.5)/4.5 = (x - 50)/15$ **oe**
One correct method seen **M1**
40 **A1**
25 **A1**
- (ii) Written test as the scaled mark is higher **B1** ✓
Or written test as her marks are below the mean in both tests, but closer to the mean, in terms of the standard deviation, in the written test
- (iii) $(x - 74.5)/4.5 = (x - 50)/15$
Attempt to equate 2 standardised quantities containing the same unknown **M1**
 $x = 85$ **A1**
- 4 (i) Evidence of 4, 2, 1, 1 required from each age group **B1**
15, 38, 64, 29, 04, 70, 47, 55 **B3** (–1 each ind error)
- (ii) 50 **B1**
- (iii) Any factor that might affect views on proposal to change working hours e.g. how far from work they live, whether they have children, mode of transport they take to work, whether they are full- or part-time, hours they work now... **B1**
- Further details on why this factor might affect views on work hours **B1**
or because it could affect their views on the proposal

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- 5 (i) $1 - 1/5 - 1/3$ M1
 $7/15$ (0.47 or better) **oe** A1
- (ii) $1 - 1/5 [= 4/5]$ M1
 $'4/5' \times '4/5'$ (must be probs) M1
 $16/25$ (0.64) **oe** A1
- (OR $2 \times 1/3 \times '7/15'$ M1
 $+ 1/3 \times 1/3 + '7/15' \times '7/15'$ M1
 $16/25$ (0.64) **oe** A1)
- (iii) That the events are independent/that what he chooses on one day does not affect choice on another day/that the probabilities stay the same/that he may choose the same on consecutive days/that the choice is random **oe** B1
- (iv) Not justified as likely that choice on one day influenced by choice on previous day (or similar comment in context) B1
OR Justified as choice on one day not influenced by choice on previous day
- 6 (i) $22 + 19 = (41)$ seen in denominator M1
 $22 \times 27.2 + 19 \times 31.1 = (1189.3)$ M1
 $29.(0\dots)$ **awrt nfw** A1
- (ii) $2.30 = \sqrt{\frac{\sum x^2}{22} - 27.2^2}$ or $1.43 = \sqrt{\frac{\sum x^2}{19} - 31.1^2}$ or better M1
 16393 and 18416 **awrt** (allow 3sf or better) A1
- (iii) Use of their combined $\sum x^2$, n and $\bar{x}$ in sd or var formula M1
 2.8 or 2.7 **awrt** (must come from fully correct working) A1
- 7 (i) 3-point moving average values should be found B1
period is odd/moving average values will coincide with original data plots/moving average values are already centred B1
- (ii)
- | | |
|----------------|--------------------------|
| 2012 May – Aug | 573 |
| 2012 Sep – Dec | 566 |
| 2013 Jan – Apr | 560.7 |
| 2013 May – Aug | 534.3 |
| 2013 Sep – Dec | 512.7 |
| 2014 Jan – Apr | 489.7 |
| 2014 May – Aug | 480.7 accept 3 sf |
- Suitable table with 7 correct times corresponding to attempted moving average values B1
Sum of n values $\div n$ (may not be consecutive) M1
Sum of 3 consecutive values $\div 3$ M1
7 correct moving average values A2
(A1 for 5 or 6 correct)

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- (iii) 7 plots correct horizontally **B1**
 7 plots correct vertically (ft their 7 moving average values) **B1^{1/2}**
 Suitable straight trend line (there must be at least 3 sensible plots) **B1**
- (iv) Falling/decreasing **oe** **B1**
- (v) '896' – '580' = (316)
 '880' – '530' = (350)
 '811' – '480' = (331)
 One appropriate difference found, +/- (values may come from table or graph and if working not shown check graph) **M1***
 3 differences ÷ 3 **M1*dep**
 325 to 345 **A1**
- (vi) Reading from their graph at May – Aug 2015 + their (v) **M1**
 Correct ft, round to nearest whole number, but must be in range 745 to 785 and only ft if full marks scored in part (v) **A1^{1/2}**
- 8 (i) 100s in first column **B1**
 15120/12600 (x100) **M1**
 120 **A1**
 103 **B1**
- (ii) (a) $12 \times '120' + 2 \times 95 + 5 \times '103'$ [2145] **M1**
 $\div (12 + 2 + 5)$ [19] **M1**
 112.9 awrt or 113 **A1**
- (b) Overall costs/prices have increased (not 'expenditure' unless 'assuming weights remain unchanged' is stated) **B1**
 by 12.9% **B1^{1/2}**
 between 2012 and 2014 **B1**
- (iii) 12600/12 (= 1050) **M1**
 '1050' $\times (12 + 2 + 5)$ **M1**
 (\$)19950 **A1**
- (iv) '19950' $\times '112.9'/100$ or $('120' \times 12600 + 95 \times 2100 + '103' \times 5250)/100$ **M1**
 (\$)22500 awrt **A1**
- (v) **Amount** of raw materials may have changed. Do not allow if reasons that refer to a change in the prices/price relatives are included. **B1**
- 9 (i) Amounts that can be won \$2, \$3, \$4, \$5 and \$6 only (allow repeats) **B1**
 Table with correct amounts (allow repeats) and probabilities that add to 1 **B1**
 $2/5 \times 2/5$
 $2/5 \times 2/5 \times 2$
 $2/5 \times 2/5 + 2/5 \times 1/5 \times 2$
 $2/5 \times 1/5 \times 2$
 $1/5 \times 1/5$
 Any 2 correct methods seen (may be implied by correct results) **M2**
 (M1 any 1 correct method)
 4/25, 8/25, 8/25, 4/25, 1/25 all correct (do not allow repeats) **A1**

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(ii)	Sum of their amounts $\times$ probabilities $2 \times 4/25 + 3 \times 8/25 + 4 \times 8/25 + 5 \times 4/25 + 6 \times 1/25$ \$3.60 (allow 3.6)		M1 A1
(iii)	P(2 green) = $5/6 \times 5/6$ $n/m \times n/m$ $25/36$ $'25/36' \times 10 + ((1 - '25/36') \times 0)$ or $'25/36' \times 4 + (1 - '25/36') \times -6$ $6.9\dot{4}$ or show > 6 or $0.9\dot{4}$ or show > 0 so should play gold bonus game		M1 A1 M1 A1 A1✓
(iv)	P(2 green) = $5/6 \times 4/5$ $n/m \times (n - 1)/(m - 1)$ $2/3$ oe $'2/3' \times x + (1 - '2/3') \times -5 = 0$ or $'2/3'(5 + x) + 0 = 5$ \$2.50/\$2.51 (allow 2.5)		M1 A1 M1 A1
10 (i)	59.5 and 69.5 10		B1 B1
(ii)	70 – 79 or 69.5 – 79.5		B1
(iii)	50th (or 100/2) letter (allow 50.5th), can be seen in part (ii) 69.5 + $('50' - 35) / 46 \times 10$ 72.8		B1 M1 M1 A1
(iv)	Reference to the small number of large masses or the large number of small masses in the table and the effect of this on the mean/median (S. C. B1 only for unclear reference to 'extreme values' or unclear reference to lack of symmetry)		B1* B1dep
(v)	$(75 - 69.5) / 10 \times 46 + 25 + 10$ Some fraction of 46 Some fraction of 46 plus 25 + 10 Correct fraction of 46 or 25.3 (must be seen) 60 nfww		M1* M1dep M1 A1
(vi)	$'60' \times 0.6 + (100 - '60') \times 0.9$ \$72 (allow \$71.91 from use of 60.3)		M1 A1
(vii)	Data not evenly spread within the relevant interval (as assumed by linear interpolation)		B1

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11 (i) Change chart and Percentage sectional/component/composite bar chart **B1**

(ii)

	Compact	Standard	Luxury
2004	65	45	15
2014	60	54	36

52, 36 and 12 (may be implied) **B1**

At least one of ' $52/100 \times 125$ ', ' $36/100 \times 125$ ', ' $12/100 \times 125$ ' **M1**

65, 45 and 15 **A1**

At least one of ' $65 - 5$ ', ' $45 + 9$ ', ' $15 + 21$ ' **M1**

60, 54 and 36 **A1**

Two-way table with appropriate headings **B1**

(iii) ' $60/150 \times 100 (=40\%)$ ', ' $54/150 \times 100 (=36\%)$ ', ' $36/150 \times 100 (=24\%)$ ' **M1**

40%, 36%, 24% correctly drawn and shaded on graph **A1**

(iv) Number (of standard cars) increased (between 2004 and 2014) **B1**

Proportion (of standard cars) remained the same (between 2004 and 2014) **B1**

(v) Fully labelled (number of cars, compact, standard, luxury) dual bar chart including scale and key (automatic, manual) **B1**

At least one correct method for automatic cars **M1**

$1/6 \times '60' (=10)$, $1/3 \times '54' (=18)$, $2/3 \times '36' (=24)$

At least one correct method for manual cars **M1**

$5/6 \times '60' (=50)$, $2/3 \times '54' (=36)$, $1/3 \times '36' (=12)$ or ' $60 - '10'$ etc.

Correct bars **A1**

(vi) It shows totals **B1**