Cambridge
O Level

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Cambridge Ordinary Level

STATISTICS **4040/22**

Paper 2 **October/November 2016**

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 will not enter into discussions about these mark schemes.

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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

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

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' × '4/5' (must be probs) **M1**
16/25 (0.64) **oe** **A1**

(**OR** 2 × 1/3 × '7/15' **M1**
+ 1/3 × 1/3 + '7/15' × '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 × 27.2 + 19 × 31.1 = (1189.3) **M1**
29.(0…) **awrt nfww** **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 ÷ n (may not be consecutive) **M1**
Sum of 3 consecutive values ÷ 3 **M1**
7 correct moving average values **A2**
(**A1** for 5 or 6 correct)

(iii) 7 plots correct horizontally **B1**
7 plots correct vertically (ft their 7 moving average values) **B1**√
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**√

8 (i) 100s in first column **B1**
15120/12600 (x100) **M1**
120 **A1**
103 **B1**

(ii) (a) 12 × '120' + 2 × 95 + 5 × '103' [2145] **M1**
÷ (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**√
between 2012 and 2014 **B1**

(iii) 12600/12 (= 1050) **M1**
'1050' × (12 + 2 + 5) **M1**
($)19950 **A1**

(iv) '19950' × '112.9'/100 or ('120' × 12600 + 95 × 2100 + '103' × 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 × 2/5
2/5 × 2/5 × 2
2/5 × 2/5 + 2/5 × 1/5 × 2
2/5 × 1/5 × 2
1/5 × 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**

(ii) Sum of their amounts × probabilities **M1**
$2 \times 4/25 + 3 \times 8/25 + 4 \times 8/25 + 5 \times 4/25 + 6 \times 1/25$
\$3.60 (allow 3.6) **A1**

(iii) P(2 green) = $5/6 \times 5/6$
n/m × n/m **M1**
25/36 **A1**
'25/36' × 10 + ((1 – '25/36') x 0) or '25/36' × 4 + (1 – '25/36') × –6 **M1**
$6.9\dot{4}$ or show > 6 or $0.9\dot{4}$ or show > 0 **A1**
so should play gold bonus game **A1**√

(iv) P(2 green) = $5/6 \times 4/5$
n/m × (n – 1)/(m – 1) **M1**
2/3 **oe** **A1**
'2/3' × *x* + (1 – '2/3') × –5 = 0 or '2/3'(5 + *x*) + 0 = 5 **M1**
\$2.50/\$2.51 (allow 2.5) **A1**

10 (i) 59.5 and 69.5 **B1**
10 **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)** **B1**
69.5 + **M1**
('50' – 35)/46 × 10 **M1**
72.8 **A1**

(iv) Reference to the small number of large masses or the large number of small masses in the table **B1***
and the effect of this on the mean/median **B1dep**
(S. C. **B1** only for unclear reference to 'extreme values' or unclear reference to lack of symmetry)

(v) $(75 – 69.5)/10 \times 46 + 25 + 10$
Some fraction of 46 **M1***
Some fraction of 46 plus 25 + 10 **M1dep**
Correct fraction of 46 or 25.3 (must be seen) **M1**
60 **nfww** **A1**

(vi) '60' × 0.6 + (100 – '60') × 0.9 **M1**
\$72 (allow \$71.91 from use of 60.3) **A1**

(vii) Data not evenly spread within the relevant interval (as assumed by linear interpolation) **B1**

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 × 125, '36'/100 × 125, '12'/100 × 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' × 100 (=40%), '54'/'150' × 100 (=36%), '36'/'150' × 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 × '60' (=10), 1/3 × '54' (=18), 2/3 × '36' (=24)
At least one correct method for manual cars **M1**
5/6 × '60' (=50), 2/3 × '54' (=36), 1/3 × '36' (=12) or '60' – '10' etc.
Correct bars **A1**

(vi) It shows totals **B1**