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Cambridge Ordinary Level

MARK SCHEME for the October/November 2014 series

4040 STATISTICS

4040/22 Paper 2, maximum raw mark 100

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1	**(i)**		A variable whose outcomes can only take specific values, or can be counted or listed.	B1
	(ii)		Correct example e.g. height, weight…	B1
	(iii)		A variable which has non-numerical outcomes.	B1
	(iv)		Correct example e.g. shoe size, number of people on a bus…	B1
2	**(i)**		6	B1
	(ii)		15^{th} value or (29 + 1)/2 5 **www**	M1 A1
	(iii)		Any attempt to work with a cumulative frequency of 18 or sight of total of 35 (29 + n + 1)/2 = 18 n = 6 S. C. B1√ for 0 following an answer of 4.5 in **(ii)**	M1 A1
3	**(i)**	**(a)**	5/20 × 4/19 (n/m × (n – 1)/(m – 1)) or 5/20 × any probability 1/19 oe or 0.053 or better	 M1 A1
		(b)	(5/20 × 15/19) × 2 Product of two probabilities × 2 oe or (5/20 × 15/19) oe 15/38 **oe** or 0.39 or better	 M1 A1
	(ii)		8/20 + 12/20 × 8/20 p/m + (m – p)/m × p/m **oe** (accept additional terms for this mark) 16/25 or 0.64	 M1 A1
4	**(i)**		Median IQR The data contains extreme values (if these are specified they must be the large values of m) or data is not symmetrical. (There must be a single/the same reason.) (B3 for 2 correct measures and correct single/the same reason B2 at least 1 correct measure and correct reason for that measure B1 for median and IQR with incorrect reason or error in reasoning)	B3
	(ii)		100/150 × 19 **oe** (or accept 50/150 × 19 **oe**) 100/150 × 19 + 12 only **oe** 25	M1 M1 A1

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5 (i) Percentage sectional/component/composite bar chart B1

(ii) 42 36 22 B1
36 24 60 B1

(iii) Scale from 0, going up in equal intervals to at least their max freq with label 'no. of students' or 'frequency' (may appear in title) B1
Three pairs of bars and correct labelling on horizontal axis B1
Bars correctly shaded and drawn to correct heights (ft their **(ii)**) B1√

(iv) 'It shows actual numbers/original data, (rather than percentages)' or 'It allows for easy comparison of numbers of males and females (taking each option)'. B1

6 (i) (a) A and B, A and C, A and D (–1 each error or omission) B2

(b) B and C, C and D (–1 each error or omission) B2

(ii) EITHER
1/6 (**awrt** 0.17) and 1/2(**oe**) seen B1
$P(A \cup B) = P(A) + P(B) - P(A \cap B)$ and $P(A \cap B) = P(A) \times P(B)$ **oe** M1
7/12 **oe** (or **awrt** 0.58) A1

OR
Find that there are 21 outcomes in $A \cup B$ M1
Find that there are 36 outcomes in total M1
7/12 **oe** (or **awrt** 0.58) A1

(iii) 0 and 5/6 (**awrt** 0.83) B1

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7	**(a)**	**(i)**	Two from: To smooth out/eliminate the variation To look for the trend To find seasonal components To make predictions	B1 B1
		(ii)	3	B1
		(iii)	As n is odd (must ft their n) Moving average values correspond to original data points (must ft their n) No (dependent on one M)	M1 M1 A1√
	(b)	**(i)**	a = 75 b = 70.75 c = 82	B1 B1 B1
		(ii)	62 – 71.5 (= –9.5) or 58 – 67.75 (= –9.75) (ignore sign errors) (sum of two differences)/2 –9.6 (accept –9.63 or –9.625 or –9600 tonnes etc.)	M1 M1 A1
		(iii)	Correctly plotted points Suitable trend line	B1√ B1√
		(iv)	Attempt at a reading from trend line (even if in wrong place) + 'their **(ii)**' Ans in range 53.9 to 55 (or 53 900 to 55 000) **www**	M1 A1
8	**(i)**		Electricity = 0.09 × 5000 or 450 Wages = 6.5 × 4000 or 26 000 15 600 : 450 : 26 000 is equivalent to given ratio (÷ 50)	M1 M1 A1(**AG**)
	(ii)		100s in first column Ingredients for 2012: 108 Electricity for 2012: 0.11/0.09 × 100 or 0.02/0.09 × 100 122 (allow 122.2 or 122.2…) Wages for 2012: 97	B1 B1 M1 A1 B1
	(iii)		(312 × '108' + 9 × '122' + 520 × '97') Sum of 3 products / (312 + 9 + 520) 101.3 (or 101.4 from 122.2…) (must be 1 dp)	M1 M1 A1√
	(iv)		(15 600 + '450' + '26 000') × ('101.3' / 100) 42 600 (must be 3sf)	M1* M1dep A1√
	(v)		Two from: Amount of electricity used may have changed Number of staff/hours may have changed Amount of ingredients may have changed Weights/quantities may have changed There may be other expenses/an additional category is suggested	B1 B1

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9	(i)	(a)	1/4 or (1/2 × 1/2) seen	B1
			1/4 × 1/4 × 1/4 or (1/2 × 1/2) x (1/2 × 1/2) x (1/2 × 1/2) = 1/64 (working essential)	B1(**AG**)
		(b)	Evidence that this can happen in three ways: 110, 101, 011 or 3 × 1/4 × 1/4 × 3/4	M1
				M1
			9/64 (accept 0.14 here)	A1
			OR	
			9 ways listed HH HH HT, HH HH TH, HH HH TT,HH HT HH, HH TH HH, HH TT HH, HT HH HH, TH HH HH, TT HH HH or 9 ×	M1*
			1/4 × 1/4 × 1/4	M1dep*
		(ii)	P(0 points) = 3/4 × 3/4 × 3/4	M1
			P(1 point) = 3 × 1/4 × 3/4 × 3/4	A1
			one correct method	B1
			27/64 and 27/64 both correct (accept 0.42 here)	B1
			Table with X = 0, 1, 2, 3	
			Their probabilities sum to 1	
		(iii)	58 × '1/64'	M1*
			+ x × '*their* **(i)(b)**' = 4	M1dep
			22	A1
			OR	
			if profit used i.e. $4 subtracted from winnings then	
			54 × '1/64' + –4 × '27/64' + –4 × '27/64' + (x – 4) × '9/64' = 0 M2	
			OR	
			54 × '1/64' + –4 × '27/64' + –4 × '27/64' + y × '9/64' = 0	M1*
			y + 4	M1dep
		(iv)	1/5 (**oe**) seen	B1
			50 × 'their 1/5' + 12.5 × (1 – 'their 1/5')	M1
			$20	A1
			Correct decision based on 'their **(iii)**' and 'their $20'	A1√
			OR	
			1/5 (**oe**) seen	B1
			(50 – '22') × '1/5' + (12.5 – '22') × (1 – '1/5')	M1
			– $2	A1
			Correct decision based on –ve or +ve result	A1√

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10 (a) (i) $(0 \times 13) + 1 \times 11 + 2 \times 7 + 3 \times 6 + 4 \times 4 + 5 \times 1$ M1
64 A1

(ii) Total days = 13 + 11 + 7 + 6 + 4 + 1 (=42) M1*
'64'/'42' M1dep
1.5 (allow 1.52 or 1.524) A1

(b)

10	3
5.5	1.5
58	15
11	3

B4
(B4 for 8 correct, B3 for 6/7 correct, B2 for 4/5 correct, B1 for 2/3 correct)

(c) (i) Marks in Algebra generally higher (**oe**) B1
Marks in Algebra generally more varied (**oe**) B1

(ii) Better in Geometry together with a comparison of her mark with the class mean in terms of the class standard deviation for at least one of Algebra or Geometry. M1

Correct comparison for both e.g. 1 standard deviation above the mean in Algebra and 2 standard deviations above the mean in Geometry (may be seen as a calculation of standardised scores) A1

(iii) $(\pm)\ \frac{87-55}{10}$ or $(\pm)\ \frac{100-60}{\sigma}$ M1

$\frac{87-55}{10} = \frac{100-60}{\sigma}$ M1

$\sigma = 12.5$ A1

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11	**(i)**	47 00 51 32 85 11 67 05 10 (–1 each independent error)	B2
	(ii)	01 followed by numbers at equal intervals (not nec ints of 10) 11 21 31 41 51 61 71 81 Intervals of 10 (even if insufficient values or values out of range) 9 values at intervals of 10 all in range (wrap around if necessary)	B1 B1 B1
	(iii)	Attempt at machine totals (20, 30, 40) 2 3 4	M1 A1
	(iv)	Asad's sample over represents A (or under represents B or C) Or Asad's sample does not accurately represent the jars as he has 4 from machine A (or 2 from machine B or 3 from machine C) Omar's sample accurately represents jars filled by each machine	B1 B1
	(v)	44 03 59 14 27 20 78 60 81 (–1 each independent error)	B3
	(vi)	39/10 or 51/10 4 and 5	M1 A1
	(vii)	Because the mass of jam (in each jar) is being checked A sample stratified by machine is more appropriate	M1 A1

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