

CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge Ordinary Level

MARK SCHEME for the October/November 2014 series

4040 STATISTICS

4040/23

Paper 2, maximum raw mark 100

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- 1 (i) Mode = 17 B1
- (ii) Attempt at valid method to find median M1
Median = 16 A1
- (iii) (a) Any attempt to work with a cumulative frequency of 29 M1
 $k = 11$ A1
- (b) $k = 9$ B1
- 2 Sight of 60% or 0.6 being used B1
Any attempt to multiply a '1st class probability' by 0.4 AND a '2nd class probability' by 0.6 M1
Any attempt to multiply at least two of these products by the appropriate value of the variable M1
Attempt to sum five such 'expectations' M1
 $(0.4 \times 0.8 \times 1) + (0.4 \times 0.2 \times 2) + (0.6 \times 0.5 \times 2) + (0.6 \times 0.3 \times 3) + (0.6 \times 0.2 \times 4)$
 $0.32 + 0.16 + 0.6 + 0.54 + 0.48$
Five correct terms summed, either evaluated or unevaluated A1
2.1 A1
- 3 (i) 430 B1
- (ii) 17.2 B1
- (iii) 8131 B1
- (iv) Variance = $(8131/25) - (17.2)^2$
Use of a correct formula for variance M1*
Attempt to take square root of 'their variance' M1dep
5.42 cm A1
- 4 (i) $(x - 27)/12 = (x - 30)/6$
An appropriate equation in any form in which the two 'unknowns' are the same. M1
A correct such equation. A1
 $x = 33$ A1
- (ii) An attempt at a standardised term with the unknown s.d. in the denominator M1
 $(51 - 27)/12 = (100 - 50)/s.d.$
Correct equation in any equivalent form A1
25 A1
- 5 (i) Bar chart of correct structure B1
Bar of correct heights and chart fully annotated B1
- (ii) Two bars of equal height and full annotation B1
Percentage components correct (27-33-40) and (31-33-36) B1
- (iii) Because it directly compares the share which each item has of overall expenditure (or similar valid reason) M1
the percentage sectional chart is more useful. A1

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- 6 (a) Any reference to frequency being proportional to area in a histogram B1
 A qualitative variable has no 'class widths' which can be used to form/evaluate such areas. B1
- (b) Any valid comparison, e.g.
 A discrete variable can only take certain values within its range, whereas a continuous variable can take all values within its range. B2
 (Or, a discrete variable is counted, a continuous variable is measured.)
- (c) (i) 15 B1
 (ii) 14.5 B1

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- 7 (i) Number of boxes of balls purchased = $75/3 = 25$ M1
 Therefore cost of balls = $25 \times 50 = \$1250$ A1
 Total wages = $12.50 \times 600 = \$7500$ B1
 Required ratio = $10\,000 : 1250 : 2500 : 7500 = 8 : 1 : 2 : 6$ **AG** B1
- (ii) Balls 90 B1
 Maintenance 102, Services 105, Wages 103 (B1 for two correct) B2
- (iii) $[(102 \times 8) + (90 \times 1) + (105 \times 2) + (103 \times 6)] / 17$
 For any one product (weight $\times$ price ratio) (except for weight of 1) M1
 For attempt to sum four such products M1*
 Division by 17 M1dep
 $1734/17 = 102$ A1
- (iv) Total 2012 expenditure = \$21 250 B1
 Estimate of 2013 expenditure = $\$(21\,250 \times 102)/100$ (with or without /100) M1
 \$21 675 (or 21 700 as 3sf value) A1
- (v) Any valid reasons not accounted for by information included in the calculations (i.e. not 'inflation')
 e.g. Varying membership or number of matches played may affect the number of balls purchased. B2
- 8 (i) 2 – under 3 B1
- (ii) 8 cm B1
- (iii) 12 209 242 255 379 401 412 500 (–1 each independent error) B2
- (iv) 4 + M1
 (8 or 8.5)/13 M1
 4.62 or 4.65 A1
- (v) (Use of formulae must be consistent throughout)
 $UQ = 5 + (120 \text{ or } 120.75)/124$ M1
 $= 5.97$ (using either formula) A1
 $LQ = 2 + (113 \text{ or } 113.25)/197$ M1
 $= 2.57 \text{ or } 2.58$ A1
 $IQR = UQ - LQ = \text{awrt } 3.40$ A1
 (IQR A1 dep on at least one of the M1s)
- (vi) (a) (1.35 or 1.32) and (2.04 or 2.05 or 2.07 or 2.08) B1ft
 (b) Any valid comment relating to skewness or lack of symmetry B1ft
- (vii) The gradient will be steepest where the class frequency is highest, around the 2 – under 3 class. M1
 A1

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- 9 (a) (i) Any comment meaning the events cannot occur simultaneously B1
- (ii) Any valid examples, but the two events must both be possible outcomes of the same 'experiment' B1
- (iii) (a) Any reference to the probabilities of possible outcomes not summing to more than 1 B1
- (b) Use of $P(A) \times P(B)$ M1
0.3 A1
- (b) (i) Valid probability with a denominator of 60 M1
 $24/60 = 2/5 = 0.4$ A1
- (ii) Valid probability with a denominator of 35 or a numerator of 23 M1
 $23/35 = 0.657$ A1
- (iii) Valid probability with a denominator of 25 or a numerator of 11 M1
 $11/25 = 0.44$ A1
- (iv) Product of two valid probabilities with denominators of 60 and 59 M1
 $(5/60) \times (4/59) = 1/177 = 0.00565$ A1
- (v) $(35/60) \times [(7/35 \times 12/59) + (28/35 \times 13/59)]$
 $(35/60) \times$ an attempt at the second probability, seen M1
Product of two probabilities with denominators 35 and 59 seen M1
 $112/885 = 0.127$ (correct result) A1
- OR
- $(7/60 \times 12/59) + (28/60 \times 13/59)$
- Correct numerators in an expression of this form M1
- Correct denominators in an expression of this form M1
- $112/885 = 0.127$ A1

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- 10** (i) 12 00 07 09 01 (–1 each independent error) B2
- (ii) (a) 00 02 B1
- (b) 00 B1
- (c) 03 06 09 12 B1
- (iii) (a) 3 friends, 2 relatives B1
- (b) 06 09 08 04 02 (–1 each error) B3
- (iv) (a) Group I 2, Group II 2, Group III 1 B1
- (b) 11 13 10 02 09 (–1 each error) B2
- (v) Sample in (iii) obviously representative for F/R and also for age, so totally representative.
Clear indication of valid method M1
Correct conclusion A1
Sample in (iv) obviously representative for age but over-represents friends. (Equivalent comment regarding under-representation equally acceptable.)
Clear indication of valid method M1
Correct conclusion A1
- 11** (i) Because each 'cycle' is of length 5 days (or equivalent comment) B1
- (ii) Because the MA values are at the same point in time as the original values or some comment relating to each cycle containing an odd number of observations. B1
- (iii) Plots correct vertically B1
Plots correct horizontally B1
Either a clear cyclical pattern, or no clear upward or downward long-term trend B1
- (iv) $x = 127$ B1
 $y = 24.8$ B1
- (v) Plots correct vertically B1
Plots correct horizontally B1
- (vi) To eliminate seasonal variation, achieved well in this case. M1
A1
- (vii) Suitable straight line through plotted MA points. B1
- (viii) Use of seasonal components summing to 0. M1
 $q = -3$ A1
- (ix) Correct use of reading from their graph and Tuesday component. M1
17 (result must be an integer as discrete variable). A1ft