MARK SCHEME for the October/November 2009 question paper

for the guidance of teachers

4040 STATISTICS

4040/01   Paper 1, maximum raw mark 100

UNIVERSITY *of* CAMBRIDGE
International Examinations

1   **(i)** **(a)** 20   B1

        (b) 45 (allow 44–46)   B1

   (ii) For three 'whole canoes' and 'something'   M1

        For an accurate portrayal of 33   A1
                                                                                                                                        [4]

2   **(i)** To test whether respondents clearly understand the questions.   B1
        To test whether the responses to the questions provide the information required.   B1

   (ii) Advantage. Cheap, compared to interviewing costs.   B1
        Disadvantage. Likely low response rate.   B1
                                                                                                                                        [4]

3   **(i)** Any appreciation of the need to 'un–cumulate' the figures   M1
        Correct values (either ordered or unordered)
        12 11 11 9 8 14 12 17 17 12 17   A1
        (8 9 11 11 12 12 12 14 17 17 17)

   (ii) Mean = 140/11 (indication of a correct method)   M1
        = 12.7(272...)   A1
        Median = 12 (ft provided the M1 in **(i)** has scored)   B1ft

   (iii) Because the data are bi-modal   B1
                                                                                                                                        [6]

4   **(i)** 4   B1

   (ii) **(a)** 1, 2, 3, 4 (ft 1 up to 'their N')   B1ft

        (b) Correct method (can be implied by two correct results)   M1

N	P(N)
1	0.4
2	0.3
3	0.2
4	0.1

        Any three correct (with or without others)   A1
        All four correct (and no others)   A1
        Their values of N and P(N) presented in a suitable table   B1
                                                                                                                                        [6]

5 **(i)** Both 103s in the correct places   B1

   (ii) Both 13s in the correct places   B1

  (iii) 37 correct (ft 'their 103' – 66)   B1ft
       39 correct (ft 52 – 'their 13')   B1ft
       89 correct (ft 52 + 'their 37')   B1ft
       77 correct (ft 166 – 'their 89')   B1ft
       30 correct (ft provided both row and column totals tally)   B1

                              [7]

6 **(i)** Any attempt to use 55 and 440   M1
     (55/440) × 1000   M1
     = 125 (per thousand)   A1

  (ii) Management $3/20 \times 1000 \times 0.04 = 6$
     Technical $9/75 \times 1000 \times 0.17 = 20.4$
     Skilled $18/230 \times 1000 \times 0.41 = 32.1$
     Unskilled $25/115 \times 1000 \times 0.38 = 82.6$

     Correct method used in any one category   M1*
     One correct value or expression seen   A1
     All other correct values or expressions seen   A1
     Summing the rates for the four categories   dep M1*
     141.10 (per thousand)   (AWRT 141.1)   A1

  (iii) The category of employment structure in the factory is not the same as in the standard
      population.   B1

                                [9]

7 **(i) (a)** Quantitative   B1

     (b) Continuous   B1

  (ii) Most of the lengths are close to that intended   M1
     and so the process is quite precise.   A1

  (iii) (a) Median = 5.0074 or 5.0075   B1

      (b) LQ = 5.0055   B1

      (c) 90th percentile = value in the range 5.0105 to 5.0108 inclusive   B2

  (iv) Sight of an attempt at the cum. freq. at 5.0084   M1
     26   A1

  (v) cf's 11 and 77 seen or implied   B1
     Indication of (higher tolerance limit cf minus lower tolerance limit cf)   M1
     77 – 11 = 66   A1ft

(vi) (a) Correct method for either measure seen, or implied by a correct result   M1
Median item is [11 + (66/2)] =44th on graph
5.0077   A1

    (b) LQ item is [11 + (66/4)] =27.5th on graph
5.0064   A1
         [16]

8 (a) (i) 1 2 3 4 5 7 8 9 10 11 12   B1

    (ii) 1/6   B1

    (iii) 1/36   B1

    (iv) Correct probability expression using their answers to **(ii)** and **(iii)**   M1
1/108   A1

(b) P(first) = 1/10   B1
P(fourth) = 9/10 × 8/9 × 7/8 × 1/7 =1/10
P(last) = 9/10 × 8/9 × ……….× 2/3 × ½ × 1 = 1/10
Indication of correct method for either fourth or last   M1
P(fourth) = 1/10   A1
P(last) = 1/10   A1
Valid conclusion from their probabilities   B1ft

(c) Any appreciation of the fact that the two operations must involve discs of the same colour   B1
P(green discs moved) = 7/10 × 6/15 = 7/25
P(white discs moved) = 3/10 × 10/15 = 1/5
Correct method for either, including seeing 15 (or 14) as the second denominator   M1
P(G) = 7/25   A1
P(W) = 1/5   A1
Attempt to sum their probabilities for the two sequences   M1
7/25 + 1/5 = 12/25 (= 0.48)   A1
         [16]

9 (i) Any comment which states or implies that the standard gauge is the independent variable.   B1

  (ii) Correctly plotted points   (–1 each error or omission)   B3

  (iii) Because A, C, D and E have the four lowest x-values (or equivalent)   B1

  (iv) Method for calculating overall mean   M1
Plot of (21, 26)   A1
Method for calculating either semi-average   M1
Plot of (9.25, 14.25)   A1
Plot of (32.75, 37.75)   A1

  (v) Straight line through at least two of their points plotted in **(iv)**   B1

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(vi) m = AWRT 1.0   B1

c = AWRT 5.0   B1

y = x + 5 (for substituting their stated values of m and c in an equation of the required form)   B1ft

(vii) The equation shows that the new gauge will give a reading 5MPa greater than the accurate reading given by the standard gauge.

For any correct comment about their equation in context   M1

The new gauge calibration therefore needs to be adjusted 5 MPa downwards.

For correct description of required change to calibration   cao   A1

         [16]

10 (i) (a) Any appreciation of area being proportional to frequency   M1

Correct heights 6, 20.5, 3 (provided working seen can score even if not drawn) (one mark each)   A3

Correct heights 32, 37, 21 (must be drawn)   B1

(b) Allow either 60 – under 70 (tallest rectangle) or 80 – under 100 (highest frequency)   B1

(c) Attempt to sum 41 and 15 and divide by 7   M1

8   A1

(ii) (a) Use of correct class mid-points, seen or implied   B1

Sight of a correct method for the mean   M1

Mean = 49.8 (cao and must be 3sf)   A1

Sight of any correct method for s.d. or variance   M1

Standard deviation = AWRT 21.3 or Variance = AWRT 453.6   A1

21.3   (cao and must be 3sf)   A1

(b) Any use of the values 90 and 42   M1

A convincing explanation (can imply M1 even if 90 and 42 not mentioned)   A1

         [16]

11 (a) (i) Attempt to sum values and subtract from 125   M1

x = 15   A1

(ii) x represents the number who chose to play netball and tennis, but not hockey.   B1

(iii) Showing all working necessary for a valid comparison to be made.   M1

Netball   WWW   A1

(iv) 6 and 11 seen in correct places.   B1

17 and 39 seen in correct places.   B1

34 and 3 seen in correct places.   B1

(b) (i) 521/'their total' × 360   M1

(ii) Any appreciation of the need to use r^2 or $\sqrt{1.26}$ M1

r^2 = 25 × (126/100) or 25 × (2772/2200)   A1

r = AWRT 5.6 cm   A1

(iii) Attempt to obtain total sales for 2008 (may be seen as part of **(ii)**)   M1
Attempt to multiply 2008 total sales by (360 – sum of angles)/360   M1
$2772 \times (100/360) = 770$ A1

[16]