MARK SCHEME for the October/November 2014 series

4040 STATISTICS

4040/12   Paper 1, maximum raw mark 100

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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1 (i) correct method for mean   M1
       46.5   A1
       correct method for SD or variance   M1
       4.46 or better   A1

    (ii) mean smaller   B1
          SD larger   B1

2 (i) SD/variance = 6, 36 or 36, 6   M1
       SD = 6 and variance = 36   A1
       med = 48   B1
       LQ = 43   B1
       UQ = 53   B1

       if zero scored allow SC1 for *their* LQ, *their* med, *their* UQ in ascending order

    (ii) *their* UQ   B1✓

3 (i) (a) citizens not in the telephone directory excluded   B1

       (b) better response rate/questions can be clarified by interviewer   B1

       (c) can reach a wide range of people/efficient distribution/
             responses obtained very quickly   B1

             excludes those without internet access/
             responses may be from non citizens   B1

    (ii) (a) limited number of answers to questions possible/
             respondent may feel none of allowed answers appropriate   B1

       (b) any relevant open question   B1

4 (i) (a) 19 in correct place   B1

       (b) 20 in correct place   B1

       (c) 17 in correct place   B1

       (d) 34 in correct place   B1

    (ii) attempt to find frequencies for variable values 1, 2 (63, 81)   M1
       2   A1✓

5 (i) 15/40 or 3/8 or 0.375   B1

  (ii) 5/40 or 1/8 or 0.125   B1

 (iii) 6/15 or 2/5 or 0.4   B1

  (iv) $(17/40) \times$ M1
                (*their* 17 – 1)/(*their* 40 – 1)   M1
              272/1560 or 136/780 or 68/390 or 34/195 or 0.174 or 0.17   A1

6 (i) addition of scale readings of 10 km/h wide columns (26 + 43 + 47)   M1
       116   A1

  (ii) appreciation of area being proportional to frequency
       (may be earned here or in **(iii)** or **(iv)**)   M1
       62   A1

 (iii) 40   A1✓

  (iv) 6   A1✓

7 (i) 1 + 8 + 3 + 37 (=49)   M1
25 + 167 + 40 + 228 (=460)   M1
(*their* 49/*their* 460) × 1000   M1
106.5   A1

(ii) correct method for any job group   M1
40   47.9   75   162.3   A1

(iii) any one job group rate multiplied by standard population figure   M1
sum of four such products   M1
(40 × 0.08) + (47.9 × 0.35) + (75 × 0.12) + (162.3 × 0.45)   A1✓
102 or 102.0   A1

(iv) because its standardised accident rate is lower   M1
Fastbuild   A1✓

(v) Kwikbuild   30.7 (or Fastbuild   32.5)   B1
Fastbuild   32.5 (or Kwikbuild   30.7)   and   Kwikbuild   B1

(vi) crude   B1*
standardised rate is to eliminate differences in population structures
so is meaningless for one category   B1dep

8 (i) 280   B1

(ii) (35/100) × 120   **AG**   B1

(iii) (45/100) × 160   M1
72   A1

(iv) number completing = 65 + 39 + 10 + 71 + 46 + 37   (=268)   M1
their **(i)** – *their* 268   M1
12   A1

(v) attempted use of class mid points (75, 105, 135, 165)   M1*
correct method for mean (Σfx = 5205)   M1dep
141   A1

(vi) finds 18 + 2 + 15 + 8 + 3 + 6   (=52)   M1*
((3 + 6)/*their* 52) × 100   M1dep
17.3% or better or 17%   A1

(vii) finds 30% of 160   (=48)   M1*
((3 + 15)/*their* 48) × 100   M1dep
37.5% or 38%   A1

9 **(i)** **(a)** 23.5–23.8   B1

         (b) 26.2–26.5   B1

         (c) 21.2–21.5   B1

         (d) 29.5–29.8   B1

     (ii) **(a)** attempt to read cf% values for BMI = 18.5 and 25 and subtract
on either graph (65 – 7) (40 – 4)   M1
57(%)–59(%)   A1

         (b) 36(%)   A1

    (iii) 60% overweight   B1
attempt to read BMI for cf% = 40% + ½ × 60% (=70%) on 2010 graph   M1
28.8–29.1   A1

     (iv) attempt to read BMI for cf% = 93% on 1980 graph   M1
30   A1

Attempt to read cf% for BMI = 30 on 2010 graph   M1
22(%)   A1

     (v) population has become more unhealthy, with specific support
         median BMI increased
    or   percentage healthy decreased
    or   percentage obese increased   B1

support strengthened by
         reference to more than one of these changes
    or   citation of specific values for any change   B1

10 (i) correctly plotted points   **B2**
allow B1 for 6 or 7 correctly plotted

(ii) not in the set of four lowest x values
or any indication of need to order data by x values first   **B1**

(iii) method for calculating either semi-average   **M1**
plot of (2, 41)   **A1**
plot of (4.5, 69)   **A1**
method for calculating overall mean   **M1**
plot of (3.25, 55)   **A1**

(iv) straight line through at least two of *their* plotted points in **(iii)**   **B1**
correct method for gradient, m, of *their* line   **M1**
correct method for c   **M1**
m = 11.0 – 11.4 and c = 18 – 19   **A1**

(v) 52   **B1**✓

(vi) because its line has the greatest gradient **oe**   **M1**
Science (or Statistics if *their* m > 13.8)   **A1**✓

(vii) difficult to know if pupils perform well because they like a subject,
or they like a subject because they perform well in it   **B1**

11 (i) (a) $(0.9)^2$ **M1**
0.81 or equiv fraction   **A1**

(b) 1 – *their* 0.81   or $(0.1 \times 0.9 \times 2) + (0.1)^2$ **M1**
0.19 or equiv fraction   **A1**✓

(ii) 0.1×0.4 **M1**
$\times (0.9)^3$ **M1**
$\times 4$ **M1**
0.11664 or 0.1166 or 0.117 or 0.12 or equiv fraction (729/6250)   **A1**

(iii) (a) $(0.1 \times 0.6)^2$ **M1**
$\times 0.9 \times 3$ **M1**
0.00972 or 0.0097 or equiv fraction (243/25000)   **A1**

(b) $(0.1 \times 0.4) \times (0.9)^2 \times 3$ (L, not O, not O)   (0.0972)   **M1**
$(0.1 \times 0.6) \times (0.9)^2 \times 3$ (S, not O, not O)   (0.1458)   **M1**
$(0.9)^3$ (not O, not O, not O)   (0.729)   **M1**
addition of *their* 0.00972, *their* 0.0972, *their* 0.1458, *their* 0.729   **M1**
0.98172 or 0.9817 or 0.982 or 0.98 or equiv fraction (24543/25000)   **A1**