MARK SCHEME for the October/November 2015 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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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)** systematic   B1

    (ii) quota   B1

   (iii) stratified   B1

2 **(i)** mean or mode   B1

    (ii) median   B1

   (iii) standard deviation OR variance OR range   B1

   (iv) interquartile range   B1
       correct method for Q1 and Q3 (cf = 8, Q1 = 2; cf = 24, Q3 = 5)   M1
       3   A1

3 **(i)** one two-way table   M1
       with rows/columns headed M, F and columns/rows headed T, C, X   A1
       cell values   2, 5, 1   3, 7, 2   in correct places, totals not required   A2
       allow A1 for four or five correct

    (ii) from these data, for males no, for females yes   B1
       but sample too small for general conclusion   B1

4 **(i)** **(a)** B   B1

       (b) C   B1

       (c) C   B1

    (ii) $12 \times$ mean for any shop   M1
       sum of three such products (41.04, 56.04, 45)   M1
       142   A1

5 **(i)** any four from   1, 5, 7, 11, 13, 14, 16, 17   for first four numbers written down
       allow B1 for three correct   B2

    (ii) for   4, 4, 4 $(1/6) \times (1/6) \times (1/6)$ (=1/216)   B1
       for   6, 6, not6 $(1/6) \times (1/6) \times (5/6)$ B1
       $\times 3$ (= 15/216)   B1
       addition of all cases for 4, 4, 4 and 6, 6, not6   M1
       16/216 **oe** (2/27, 0.0741)   A1

6 (i) cumulative frequency polygon B1

(ii) 2.8 (hours) B1

(iii) attempt to read length of stay corresponding to cf = 102 M1
6.5 – 6.6 (hours) A1

(iv) correct method for numbers in paying categories
(88 – 48 or 112–88 or 120–112, 40 or 24 or 8) M1

correct payment in a paying category
(88–48) $\times$ 6   or (112–88) $\times$ 9   or (120–112) $\times$ 12
(40 $\times$ 6   or 24 $\times$ 9   or 8 $\times$ 12)
and total of numbers in two adjacent categories is 64 or 32 A1

correct method for total payment *(at least one correct product)*
(240 + 216 + 96) M1

$552 A1

7 (i) correct method for overall mean M1
overall mean (12.5, 60.3) A1
correct method for LSA or USA M1
LSA (5, 77.7) A1
USA (20, 43) A1

(ii) correct method for gradient M1
correct method for *c* M1
$m = -2.306$ to -2.320 and $c = 89.1$ to 89.4 A1

(iii) use of $x = 30$ in their equation M1
20 °C A1✔
ft only if gradient negative and answer is less than 38°

(iv) correctly plotted points B2
allow B1 for five correct

(v) straight line with negative gradient, for $t = 0$ to $t = 30$ M1
correct line joining (0, 89) and (30, 20)
OR line joining (0, *their c*) and (30, *their* 20) A1✔

(vi) relationship between the variables is not linear B1

(vii) will be higher than that calculated B1

8 **(i)** 748   B1

  (ii) (525/1614) × 100 **AG**   B1

  (iii) ((53 + 60 + 51 + 39)/1614) × 100   M1
       awrt 12.6(%)   A1

  (iv) indication of area being proportional to class frequency   M1

       rectangles
       width 2   height 33   A1
       width 3   height 24   A1
       width 5   height 12   A1

  (v) (90/360) × 144   M1
       36   A1

  (vi) finds (80/360) × 144 (= 32)   M1*
       (*their* 32/525) × 100   M1dep
       awrt 6.10(%) or **awrt** 6.1(%)   A1

  (vii) finds (70/360) × 144 × 0.5 (= 14)   M1*
       (*their* 14/*their* 203) × 100   M1dep
       6.90(%) or 6.9(%)   A1

9 **(i)** **(a)** 11   B1

       (b) 6   B1

       (c) 4   B1

       (d) 2   B1

       (e) 8/30 **oe**   B1

       (f) 6/14 **oe**   B1

  (ii) **(a)** 4   B1

       (b) 9   B1

       (c) 16   B1

       (d) 0   B1

  (iii) for the swimmer 17/30   B1
       for the track athlete 8/20   B1
       multiplication of their swimmer and track athlete probabilities not multiplied by 2   M1
       (provided at least one B1 earned)
       17/75 **oe**   A1

  (iv) any Venn diagram with a triple intersection of 1 and double intersections of 5, 2, 0   M1
       fully correct and annotated diagram   A1

10 (i) 6 – under 9   B1

   (ii) attempted use of class mid-points (1.5   4.5   7.5   10.5   13.5   17.5)   M1*
correct method for mean   (Σfx = 386)   M1dep
7.72   A1
finding values of $f \times$ variable squared   M1
correct method for SD or variance (Σfx^2 = 3798.5, $\Sigma fx^2 / \Sigma f$ = 75.97)   M1dep
4.04 to 4.05   A1
4.05   A1

  (iii) km^2 B1

  (iv) 12   B1
20   B1

   (v) (1) $\times$ (1/5) $\times$ p $\times$ q M1
(1) $\times$ (1/5) $\times$ (1/4) $\times$ (1/3)   A1
1/60 **oe**   (0.0167)   A1

  (vi) (1 – *their* 1/60) $\times$ *their* 1/60   M1
59/3600 **oe**   (0.0164)   A1✓

11 (i) 6 + 35 + 680 + 961   (= 1682)   M1
4000 + 5600 + 8500 + 6200   (= 24300)   M1
(*their* 1682/*their* 24300) $\times$ 1000   M1
69.22   A1

  (ii) correct method for any medical condition   M1
1.5   6.25   80   155   A1

  (iii) any one medical condition rate multiplied by standard population figure   M1
sum of four such products   M1
(1.5 $\times$ 0.15) + (6.25 $\times$ 0.25) + (80 $\times$ 0.40) + (155 $\times$ 0.20) **oe**   A1✓
64.79   or   64.7875   A1

  (iv) (1.4 $\times$ 0.15) + (6.25 $\times$ 0.25) + (85 $\times$ 0.40) + (162 $\times$ 0.20) **oe**   M1
68.17   or   68.1725   A1

   (v) correct method for deaths at Southshore
(1.4 $\times$ 5) + (6.25 $\times$ 6.4) + (85 $\times$ 7.8) + (162 $\times$ 5.5)   (=1601)   M1
81   (ft only on their 1682)   A1✓

  (vi) because it has the higher standardised mortality rate
OR because mortality rates are higher for groups most at risk   M1
Southshore   A1✓