UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Ordinary Level

MARK SCHEME for the October/November 2009 question paper for the guidance of teachers

4040 STATISTICS

4040/02 Paper 2, 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.

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1 **(i)** Any valid argument relating to use of true, rather than stated, class limits.

(ii) 2 15 35 57 74 79 B1

(iii) Determination of 60th item as the upper quartile B1
129.5 +
['their 3'/17] × 20 M1
133.0 g (must be 1dp) A1
[6]

2 **(i)** Any valid comment relating to the fact that P(A) + P(B) is greater than 1. B1

(ii) $P(A \cup B) = P(A) + P(B) - P(A \cap B) = 0.55 + 0.7 - 0.4$
Correct use of formula M1
= 0.85 A1
In **(iii)** allow ft only if results are valid probabilities.

(iii) **(a)** 1 – 0.85 = 0.15 WWW (ft 1 – 'their 0.85') B1ft

(b) Use of P(A) + P(B) – 2P(A∩B) = 0.55 + 0.7 – 0.8
or 'their **(ii)**' – 0.4
or 0.6 – 'their **(iii) (a)**'
Any valid method M1
0.45 A1ft
[6]

3 **(i)** A (Simple) random sampling B1
D Systematic sampling B1

(ii) Unbiased A C D Biased B E
(–1 each error or omission) B2

(iii) B biased because the claims do not all have an equal chance of selection B1
E biased because doesn't involve random selection (or any other valid statement) B1
[6]

4 A False B1
B False B1
C False B1
D True B1
E True B1
F False B1
[6]

5 **(i)** Three dual bars with all heights correct. B1*
Full annotation. B1*dep

(ii) Two bars of equal height with sections numerically correct. B1**
Full annotation B1**dep

(iii) Dual chart illustrates comparison of the two years for each hospital
Sectional chart illustrates comparison of use of each hospital in each year B

6 **(i)** Attempted use of an assumed mean of 299 M1
Mean of X = 0.63 A1
Use of X-values in a correct formula for s.d. or variance M1
s.d. = 0.43 A1

(ii) Mean of results = 299.63 B1ft
s.d. of results = 0.43 B1ft

[6]

7 **(a)** Any appreciation of the mean being affected by both increases M1
Attempt to use a valid standardisation procedure for the mean M1
{[230 – 20] × 35} / 30 + 25 or valid argument using multiples of s.d. above or below mean M1
Mean = $270 A1
Any appreciation of the s.d. being affected by only the per subject increase M1
New s.d. = 90 × (35/30) M1
= $105 A1

(b) **(i)** 32 and 24 seen as marks for Papers I and II B1
48 × (5/4) = 60 B1
Final mark = 32 + 24 + 60 = 116 B1

(ii) Correct standardisation method applied (may be implied by correct answer for either Paper I or Paper II mark) M1*
Scaled Paper I mark = 35 A1
Scaled Paper II mark = 30 A1
Scaled Paper III mark = 50 B1
Summing the scaled marks dep M1*
35 + 30 + 50 = 115 A1

[16]

8 **(i)** Attempt to sum relevant angles and express as a proportion of 360 M1
P(W) = 1/10 = 0.1 A1
P(L) = ½ = 0.5 A1
P(SA) = 2/5 = 0.4 A1
(The M1 may be implied by any one correct probability.)

Sequence of outcomes	Probability	Amount won ($)
W	1/10 = 0.1	5
L	½ = 0.5	0
SA W	1/25 = 0.04	6
SA L	1/5 = 0.2	1
SA SA W	2/125 = 0.016	7
SA SA SA	8/125 = 0.064	3
SA SA L	2/25 = 0.08	2

(ii) Correct sequences (–1 each error or omission) B2

(iii) Correct probabilities (–1 each error or omission, but allow ft from **(i)** for first two) B2

(iv) Correct amounts won (–1 each error or omission) B2

(v) Appreciation of need to select outcomes which win $2. M1
0.08 (ft sum of prob of selected outcomes) A1ft

(vi) Attempt at correct method of finding expected amount won M1*
$1.40 A1
Comparison of result with $2. dep M1*
Loss of 60 cents. A1ft

[16]

9 **(i)** Insurance and Tax = 440 = 450 B1
Maintenance = 55 × (19000/1000) M1
= 1045 = 1050 A1
Fuel (0.9 × 19000 × 7.8)/100 M1
= 1333.8 A1
= 1350 A1

(ii) Any attempt to relate weights to total costs M1
3 : 7 : 9 A1

(iii) Fuel price relative = (1.08/0.9) × 100 = 120
(needn't be evaluated, but to score MUST include '×100') B1
Following M-marks may score using 'their' figures
[(111 × 3) + (108 × 7) + (120 × 9)]/(3 + 7 + 9) correct numerator M1
divided by correct denominator dep M1*
= 2169/19 = 114.2 A1

(iv) (2820 × 'their 114.2')/100
= $3220 must be to nearest $10 A1

(v) Any valid comments score, e.g.
May have changed to a car with a different consumption B1
May have travelled a considerably different distance B1

[16]

10 (i) .2 × .2 × .2 or 1/5 × 1/5 × 1/5 M1
= 0.008 or 1/125 A1

(ii) $(.2)^3 + (.35)^3 + (.45)^3$ or $(1/5)^3 + (7/20)^3 + (9/20)^3$
sum of three products each containing three terms M1
sum of correct products A1
= 0.142 or 71/500 A1

In **(iii)**, **(v)** and **(vi)** accept decimal results to 3sf or more.

(iii) .35 × .35 × .45 or 7/20 × 7/20 × 9/20 M1*
×3 dep M1*
= 0.165375 or 1323/8000 A1

(iv) .35 × .45 × .2 or 7/20 × 9/20 × 1/5 M1
×6 M1
= 0.189 or 189/1000 A1

(v) Sight of 0.65 or 13/20 (anywhere) B1
.35 × .35 × .65 × 3 or 7/20 × 7/20 × 13/20 × 3 M1
= 0.238875 or 1911/8000 A1

(vi) ['their **(i)**] / ['their **(ii)**'] M1
= 0.0563 or 4/71 A1ft

[16]

11 (i) Because each value is the average of an even number of observations
(or equivalent comment.) B1

(ii) w =246 x =483 y = 59.375 one mark for each B3

(iii) The value for quarter I of 2008 is not given (or equivalent comment) B1

(iv) Suitable scales used B1
Full annotation B1
Correct plots (ft 'their' y) –1 each error or omission B3

(v) Single straight line passing centrally through the plotted points M1
The overall trend is a gradual decrease in sales A1

(vi) Any appreciation of the fact that the quarterly components must sum to 0 M1
q = 6.9 A1

(vii) Attempt to read the line at the correct point AND subtract 5.9 M1
Value from 'their' reading A1ft

[16]