

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

4040/02	4040 STATISTICS Paper 2, maximum raw mark 100
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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 must be read in conjunction with the question papers and the report on the examination.

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1	(i) Any valid argument relating to use of true, rather than stated, class limits.	B1	
	(ii) 2 15 35 57 74 79	B1	
	(iii) Determination of 60th item as the upper quartile 129.5 + [their 3/17] × 20 133.0 g (must be 1dp)	B1 M1 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 $= 0.85$ In (iii) allow ft only if results are valid probabilities.	M1 A1	
	(iii) (a) $1 - 0.85 = 0.15$ WWW (ft 1 – 'their 0.85')	B1ft	
	(b) Use of $P(A) + P(B) - 2P(A \cap B) = 0.55 + 0.7 - 0.8$ or 'their (ii) – 0.4 or 0.6 – 'their (iii) (a)' Any valid method 0.45	M1 A1ft	[6]
3	(i) A (Simple) random sampling D Systematic sampling	B1 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 E biased because doesn't involve random selection (or any other valid statement)	B1 B1	[6]
4	A False B False C False D True E True F False	B1 B1 B1 B1 B1 B1	[6]
5	(i) Three dual bars with all heights correct. Full annotation.	B1* B1*dep	
	(ii) Two bars of equal height with sections numerically correct. Full annotation	B1** B1**dep	

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	(iii) Dual chart illustrates comparison of the two years for each hospital Sectional chart illustrates comparison of use of each hospital in each year	B1 B1	[6]
6	(i) Attempted use of an assumed mean of 299 Mean of X = 0.63 Use of X-values in a correct formula for s.d. or variance s.d. = 0.43	M1 A1 M1 A1	
	(ii) Mean of results = 299.63 s.d. of results = 0.43	B1ft B1ft	[6]
7	(a) Any appreciation of the mean being affected by both increases Attempt to use a valid standardisation procedure for the mean {[230 – 20] × 35} / 30 + 25 or valid argument using multiples of s.d. above or below mean Mean = \$270 Any appreciation of the s.d. being affected by only the per subject increase New s.d. = 90 × (35/30) = \$105	M1 M1 M1 A1 M1 M1 A1	
	(b) (i) 32 and 24 seen as marks for Papers I and II 48 × (5/4) = 60 Final mark = 32 + 24 + 60 = 116	B1 B1 B1	
	(ii) Correct standardisation method applied (may be implied by correct answer for either Paper I or Paper II mark) Scaled Paper I mark = 35 Scaled Paper II mark = 30 Scaled Paper III mark = 50 Summing the scaled marks 35 + 30 + 50 = 115	M1* A1 A1 B1 dep M1* A1	[16]

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- 8 (i) Attempt to sum relevant angles and express as a proportion of 360 M1
 $P(W) = 1/10 = 0.1$ A1
 $P(L) = 1/2 = 0.5$ 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	$1/2 = 0.5$	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 = $55 \times (19000/1000)$ M1
= $1045 = 1050$ A1
Fuel $(0.9 \times 19000 \times 7.8)/100$ M1
= 1333.8 A1
= 1350 A1
(ii) Any attempt to relate weights to total costs M1
3 : 7 : 9 A1
(iii) Fuel price relative = $(1.08/0.9) \times 100 = 120$ B1
(needn't be evaluated, but to score MUST include '×100')
Following M-marks may score using 'their' figures
 $[(111 \times 3) + (108 \times 7) + (120 \times 9)] / (3 + 7 + 9)$ correct numerator M1
divided by correct denominator dep M1*
= $2169/19 = 114.2$ A1

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	(iv) $(2820 \times \text{'their } 114.2')/100$ = \$3220 must be to nearest \$10	M1 A1	
	(v) Any valid comments score, e.g. May have changed to a car with a different consumption May have travelled a considerably different distance	B1 B1	[16]
10	(i) $.2 \times .2 \times .2$ or $1/5 \times 1/5 \times 1/5$ = 0.008 or 1/125	M1 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 sum of correct products = 0.142 or 71/500	M1 A1 A1	
	In (iii), (v) and (vi) accept decimal results to 3sf or more.		
	(iii) $.35 \times .35 \times .45$ or $7/20 \times 7/20 \times 9/20$ $\times 3$ = 0.165375 or 1323/8000	M1* dep M1* A1	
	(iv) $.35 \times .45 \times .2$ or $7/20 \times 9/20 \times 1/5$ $\times 6$ = 0.189 or 189/1000	M1 M1 A1	
	(v) Sight of 0.65 or 13/20 (anywhere) $.35 \times .35 \times .65 \times 3$ or $7/20 \times 7/20 \times 13/20 \times 3$ = 0.238875 or 1911/8000	B1 M1 A1	
	(vi) ['their (i)] / ['their (ii)] = 0.0563 or 4/71	M1 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 Full annotation Correct plots (ft 'their' y) –1 each error or omission	B1 B1 B3	
	(v) Single straight line passing centrally through the plotted points The overall trend is a gradual decrease in sales	M1 A1	
	(vi) Any appreciation of the fact that the quarterly components must sum to 0 $q = 6.9$	M1 A1	
	(vii) Attempt to read the line at the correct point AND subtract 5.9 Value from 'their' reading	M1 A1ft	[16]