

### Mark scheme January 2004

# GCE

### **Mathematics & Statistics B**

## **Unit MBS1**

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#### Key to mark scheme

Μ	mark is for	method
m	mark is dependent on one or more M marks and is for	method
Α	mark is dependent on M or m mark and is for	accuracy
В	mark is independent of M or m marks and is for	method and accuracy
Ε	mark is for	explanation
or ft or F		follow through from previous
		incorrect result
CAO		correct answer only
AWFW		anything which falls within
AWRT		anything which rounds to
AG		answer given
SC		special case
OE		or equivalent
A2,1		2 or 1 (or 0) accuracy marks
-x EE		Deduct <i>x</i> marks for each error
NMS		No method shown
PI		Perhaps implied
c		Candidate

#### Abbreviations used in marking

MC-x	deducted x marks for miscopy
MR - x	deducted x marks for misread
ISW	ignored subsequent working
BOD	gave benefit of doubt
WR	work replaced by candidate

### Application of mark scheme

Correct answer without working	mark as in scheme
Incorrect answer without working	zero marks unless specified otherwise

Award method and accuracy marks as appropriate to an alternative solution using a correct method or partially correct method.

Question	Solution	Marks	Total	Comments
Number and part				
1(a)(i)	P(6  or fewer) = 0.3782	M1		Correct use of Poisson tables or formula
1(u)(l)		A1		0.378 (0.378 - 0.379)
(ii)	P(8) = 0.6620 - 0.5246 = 0.137	M1		P(8) = P(8  or fewer) - P(7  or fewer)
		A 1	4	or use of correct formula $0.127 (0.127 + 0.128)$
		AI	4	0.137 (0.137, 0.138)
(1)		141		
(b)	$\sqrt{7.5} = 2.74$		2	method sc B1 var = $7.5$
	Total	711	6	2.14 (2.13, 2.14)
2 (a)	0.209	B3	3	0.209 - 0.21
				allow M2A1 if method shown
(b)	Little evidence of linear association	E1√	2	Small/weak/no
	between Henri's and Michelle's	EI√	2	Some evidence of agreement
	is suggests some agreement			'linear' (not for 'positive')
	Total		5	
3 (a)(i)	Mean number of courses of treatment for			
	all adult dental patients in England	E1		Definition implied
(ii)	Mean for participants	E1	2	In context
(b)(i)	All teachers	E1		Reason
(ii)	No. all from local schools	M1		No
(11)		A1	3	Reason
	Total		5	

Question	Solution	Marks	Total	Comments
Number				
4(a)	26 26 27 27 28 28 30 31 33 35 39			
+ (a)	42 44 46 71	M1		Attempt at ranking
	median 31	m1		8th observation
	lower quartile 27	m1		4th observation, allow 3.75th
	upper quartile 42	m1		12th observation, allow 11.25th or 12.25th
				or 12.5th
		A1	5	31 cao, 27 cao, 42 (39 ,43)
(b)	Outliers > 42 + 1.5 (42 - 27) = 64.5	M1		method for one boundary – their
	and $< 27 - 1.5(42 - 27) = 4.5$			quartiles – allow factors between 1 and 2
	71 only outlier	ml		method for identification of outliers (both
		A1	3	64.5 (57, 67) and correct identification of
				71 as only outlier
A(c)		M1		method generous (allow omit median)
4(0)		B1		Whiskers end at 26 and 46 and outlier
	*	DI		correctly shown (approx correct)
		A1	3	Accurate plot by eye
	0 10 20 30 40 50 60 70 Time, minutes			
(d)	All times in 2nd week greater that any	E2.1	2	Clear statement scores both marks
(-)	times in 1st and 3rd weeks	,_	_	
	Total		13	
5(a)(i)	$z = \frac{172.5 - 168}{1.5} = 1.0$	M1		method of standardising – ignore sign
	4.5 P( $>1725$ ) = 0.841	M1		A correct use of normal tables
	1((172.5) = 0.041	A1	3	0.841(0.841, 0.842)
(ii)	159-168		5	
()	$z_1 = \frac{100 - 100}{4.5} = -2.0$	M1		method of standardising – consistent signs
	т.5			
	$z_2 = \frac{163.5 - 168}{100} = -1.0$	ml		Signs of z clearly correct
	4.5			
	Probability between 159 and 163.5 is	M1		Correct method – depends on M1 only
	0.97/25 - 0.84134 = 0.136	Al	4	(0.1355, 0.1365)
(b)	172-168			4.5
(-)	$z = \frac{1}{45}$	B1		Use of $\frac{110}{\sqrt{11}}$
	$\frac{110}{\sqrt{11}}$	M1		vii mothod for z
	-2.948	1411		
	P(mean > 172) = 1 - 0.9984 = 0.0016	m1		Completely correct method
	1 (1000 + 112) = 1 = 0.0010	A1	4	0.0016 (0.0015, 0.0017)
(c)	Very unlikely 11 randomly selected	E2,1	2	Clear explanation scores 2 marks
	female students would have a mean			
	height as great as 172cm		4 -	
	Total		13	

Question	Solution	Marks	Total	Comments
Number				
and part				
6(a)(i)	Binomial $n = 8 p = 0.3$	B1		Binomial
		B1		8, 0.3
	P(2  or fewer) = 0.552	BI		0.552 (0.551, 0.5525)
(11)	P(2) = 0.5518 - 0.2553 = 0.2965	M1		P(2  or fewer) - P(1  or fewer)  or use of correct formula
		A1		0.2965 (0.296 , 0.297)
(iii)	P(>3) = 1 - 0.8059 = 0.194	M1		P(>3) = 1 - P(3  or fewer)  or use of
		Δ1	7	0.194(0.193, 0.195)
			7	sc B1 0.448 (0.448 , 0.449)
(b)	No, <i>n</i> not constant/probabilities not	M1		No
	random/not independent/0,1 not possible			
	outcomes	A1	2	Reason
(c)	No, $p$ not constant/ not independent	M1		No
		A1	2	Reason
	Total		11	
7(a)	0.3	B1	1	0.3 cao
(b)	$0.6 \times 0.3 \times 0.75 = 0.135$	M1		3 probabilities multiplied
. ,		m1		Correct method
		A1	3	0.135 cao
(c)(i)	$0.4 \times 0.3 + 0.12$	M1		method – may be earned in (ii)
		A1		0.12 cao
(ii)	$0.75 \times 0.4 = 0.3$	A1	3	0.3 cao
(d)	$0.5 \times 0.12 + 0.5 \times 0.3 = 0.21$	M1		Use of 0.5
		m1		Correct method
		A1	3	0.21 cao
	Total		10	

Question	Solution	Marks	Total	Comments
Number				
and part				
8(a)	(See graph on next page)	M1		method for scatter diagram
		BI		Scales and labels
		Al	3	Accurate plot (by eye) allow one small slip
(b)	$y = -2.70 \pm 0.268 r$	B2		-2.70(-2.69) - 2.7) sc B1.2.70
(0)	$y = -2.70 \pm 0.208x$	B2 B2		0.268(0.268, 0.269)
	x = 20 $y = 2.67$ $x = 200$ $y = 50.99$	D2		Allow M1 A1 M1 A1 if method shown
		M1		method for line
	+ me	A1	6	Accurate line
			-	
(c)(i)	I 17 – (–2.6951) – 0.268437 ×88	M1		method their line – ignore sign
	= -3.93			
	J 47 – (–2.6951) – 0.268437 ×195	m1		method needs all previous M marks-
	= -2.65			ignore sign
		A1	3	-3.93 (-3.8, -4) and -2.65 (-2.5, -2.7)
				allow read from graph, allow $-3$
(ii)	5.13	M1	-	Method
		Al	2	5.13 (5.1, 5.2)
	25.0	D 1	1	
(d)(1)	26.8	BI	1	26.8 (26.7, 27)
(ji)	f22 about f5 below amount predicted by	<b>F1</b> ∧		Below predicted amount
(11)	regression equation Similar to mean			below predicted amount
	residual No reason to say Karen should	<b>F</b> 1.∕`	2	No reason to say she should have been
	have been supervised		2	supervised with references to residuals
	have been supervised.			implied
	Total		17	
	TOTAL		80	

#### Graph for Q 8(a)

