GCE 2004
November Series

ASSESSMENT and QUALIFICATIONS ALLIANCE

Mark Scheme

Mathematics and Statistics B
MBS1

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Key to Mark Scheme

M	mark is for	method
m	mark is dependent on one or more M marks and is for	method
A	mark is dependent on M or m mark and is for	accuracy
B	mark is independent of M or m marks and is for	method and accuracy
E	mark is for	explanation
√or ft		follow through from previous incorrect result
cao		correct answer only
cso		correct solution only
awfw		anything which falls within
awrt		anything which rounds to
acf		any correct form
ag		answer given
sc		special case
oe		or equivalent
sf		significant figure(s)
dp		decimal place(s)
A2,1		2 or 1 (or 0) accuracy marks
–*x* ee		deduct *x* marks for each error
PI		possibly implied
sca		substantially correct approach

Abbreviations used in Marking

MC –*x*	deducted *x* marks for mis-copy
MR –*x*	deducted *x* marks for mis-read
isw	ignored subsequent working
bod	gave benefit of doubt
wr	work replaced by candidate
fb	formulae book

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.

Mathematics and Statistics B Statistics 1 MBS1 November 2004

Question Number and Part	Solution	Marks	Total	Comments
1(a)(i)	0.2600	B1		0.2600 (0.2595 to 0.2605)
(ii)	P(14) = 0.5704 – 0.4644 = 0.106	M1		P(14)= P(14 or fewer) – P(13 or fewer) or correct use of formula
		A1	3	0.106 (0.1055 to 0.1065)
(b)	1 – 0.8272 = 0.173	M1		1 – P(17 or fewer)
		A1	2	0.173 (0.172 to 0.173)
	Total		**5**	
2	1. probably incorrect (B) - would expect negative correlation coefficient	B1 E1		Probably incorrect Negative expected
	2. Definitely incorrect (C) - *r* cannot exceed 1	B1 E1		Definitely incorrect Cannot exceed 1
	3. Plausible (A) - probably both related to population of town	B1 E1	6	Plausible Related to population of town
	Total		**6**	
3(a)	Number students 000 to 409	E1		Valid numbering
	Select 3 digit random numbers	E1		Select 3-digit random numbers
	Ignore repeats	E1		Ignore repeats
	Ignore > 409	E1		Ignore > 409 consistent with their numbering
	Continue until 20 obtained and choose corresponding students	E1	5	20 obtained/select corresponding students
(b)(i)	Incomes in 2003 of the 410 students	B1		Incomes
		B1	2	410 students
(ii)	Mean income of the sample of 20 students	B1		Mean/s.d/...
		B1	2	Sample
(c)	Incomes of all mathematics graduates	B1	1	Valid population; must mention incomes
	Total		**10**	
4(a)(i)	$0.8 \times 0.7 = 0.56$	B1		0.56 cao
(ii)	$0.2 \times 0.3 = 0.06$	M1		Method
		A1		0.06 cao
(iii)	$0.8 \times 0.3 + 0.2 \times 0.7 = 0.38$	M1		Method - allow small slip
	(or $1 – 0.56 – 0.06 = 0.38$)	A1	5	0.38 cao
(b)(i)	$0.8 \times 0.7 \times 0.95 = 0.532$	B1		0.532 cao
(ii)	$0.8 \times 0.3 \times 0.95 + 0.2 \times 0.7 \times 0.15$ …	M1		Attempt at P(2) + P(3) or equivalent
	…+ $0.8 \times 0.7 \times 0.05 + 0.532 = 0.809$	M1		Reasonable attempt at evaluating P(2) (or P(1) if relevant)
		m1		Completely correct method
		A1	5	0.809 cao
	Total		**10**	

MBS1 (cont)

Question Number and Part	Solution	Marks	Total	Comments
5(a)	Question 1: suitable	B1		Suitable
	Question 2: not suitable; classes not mutually exclusive	M1 A1		Not suitable Not mutually exclusive
	Question 3: not suitable; time is continuous	M1 A1	5	Not suitable Time continuous variable (Maximum B1 M1 if no valid reasons)
(b)	Class Frequency Frequency density 0.5 - 43 43 1.5 - 666 333 3.5 - 250 125 5.5 - 10.5 41 8.2	B1 M1 m1 B1 A1	5	Choose question 3 Method for frequency density Method for histogram Scales, labels, no gaps Reasonably accurate plot, by eye (No marks if questions 1 or 2 chosen)
	Total		**10**	
6(a)(i)	Binomial $n = 6$ $p = 0.5$ P(more than 4) = 1 – 0.8906 = 0.109	B1 M1 A1	3	B(6, 0.5) P(more than 4) = 1 – P(4 or fewer) 0.109 (0.109 to 0.11)
(ii)	P(6) = 1.0000 – 0.9844 = 0.0156	M1 A1	2	P(6) = 1 – P(5 or fewer) or P(6 or fewer) – P(5 or fewer) or correct use of formula 0.0156 (0.015 to 0.016)
(b)	14 out of 900 = 0.0156 It appears the proportion of unit trusts outperforming the stock market average over a six-year period is consistent with a random selection of investments	M1 E1√ E1	3	Appropriate calculation attempted Conclusion consistent with their earlier results Appropriate conclusion based on correct calculations
	Total		**8**	

MBS1 (cont)

Question Number and Part	Solution	Marks	Total	Comments
7(a)(i)	$z = \frac{75-85}{8} = -1.25$	M1		Method for z; ignore sign
	P(< 75) = 1 – 0.89435	M1		A correct use of normal tables
	= 0.106	A1	3	0.106 (0.105 to 0.106)
(ii)	$z_2 = \frac{81-85}{8} = -0.5$	M1		Completely correct method; allow both z's positive
	Probability between 75 and 85 is	M1		Reasonable attempt, both z's negative
	0.89435 – 0.69146 = 0.203	A1	3	0.203 (0.202 to 0.204)
(b)	85 + 3.0902 × 8 = 110	B1		3.09 or 3.0902
		M1		(their z) × 8
		m1		Completely correct method
		A1	4	110 (109 to 110)
(c)(i)	$z = \frac{81-85}{\frac{8}{\sqrt{4}}} = -1$	M1		Use of $\frac{8}{\sqrt{4}}$
		m1		Correct method for z
	Probability mean less than 81			
	= 1 – 0.84134 = 0.159	m1		Completely correct method
		A1	4	0.159 (0.158 to 0.16)
(ii)	1 – 0.69146 = 0.309	M1		Attempt to calculate probability flight time less than 81 minutes
		A1	2	0.309 (0.308 to 0.31)
	Total		**16**	
8(a)	(see graph on next page)	M1		Method for scatter diagram
		A1	2	Reasonably accurate plot by eye, allow one small slip, disallow for joined up points
(b)	$y = -81.4 + 5.50x$	B2		–81.4 (–81.35 to –81.45), allow M1A1
		B2		5.50 (5.49 to 5.51), allow M1A1
	$x = 20$ $y = 28.6$ $x = 60$ $y = 248.7$	M1		Method for line
		A1	6	Accurate line
(c)(i)	147 – (–81.4) - 5.50 × 45 = –19.2	M1		Method - ignore sign, allow read from graph
(ii)	298 – (–81.4) - 5.50 × 65 = 21.8	m1		Consistent signs or both correct ignoring signs
		A1	3	–19.2 (–19 to –19.4) and 21.8 (21.6 to 22)
(d)(i)	260	B1	1	260 (259 to 260)
(ii)	Both graph and residuals suggests that in this region the actual time will exceed time predicted by regression equation	E1	1	Reason
(e)	Appropriate regression equation would be $x = a + by$ since number of step-ups now depends on time	E1		$x = a + by$
		E1	2	Reason
	Total		**15**	
	TOTAL		**80**	

MBS1 (cont)

Graph for Question 8 (a) and (b)