GCE 2005
January 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 marks 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 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 *x* marks for each error
NMS ..... no method shown
PI ..... possibly implied
SCA ..... substantially correct approach
c ..... candidate
SF ..... significant figure(s)
DP ..... decimal place(s)

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 ..... given benefit of doubt
WR ..... work replaced by candidate
FB ..... formulae booklet

Application of Mark Scheme

No method shown:
Correct answer without working ..... mark as in scheme
Incorrect answer without working ..... zero marks unless specified otherwise

More than one method/choice of solution:

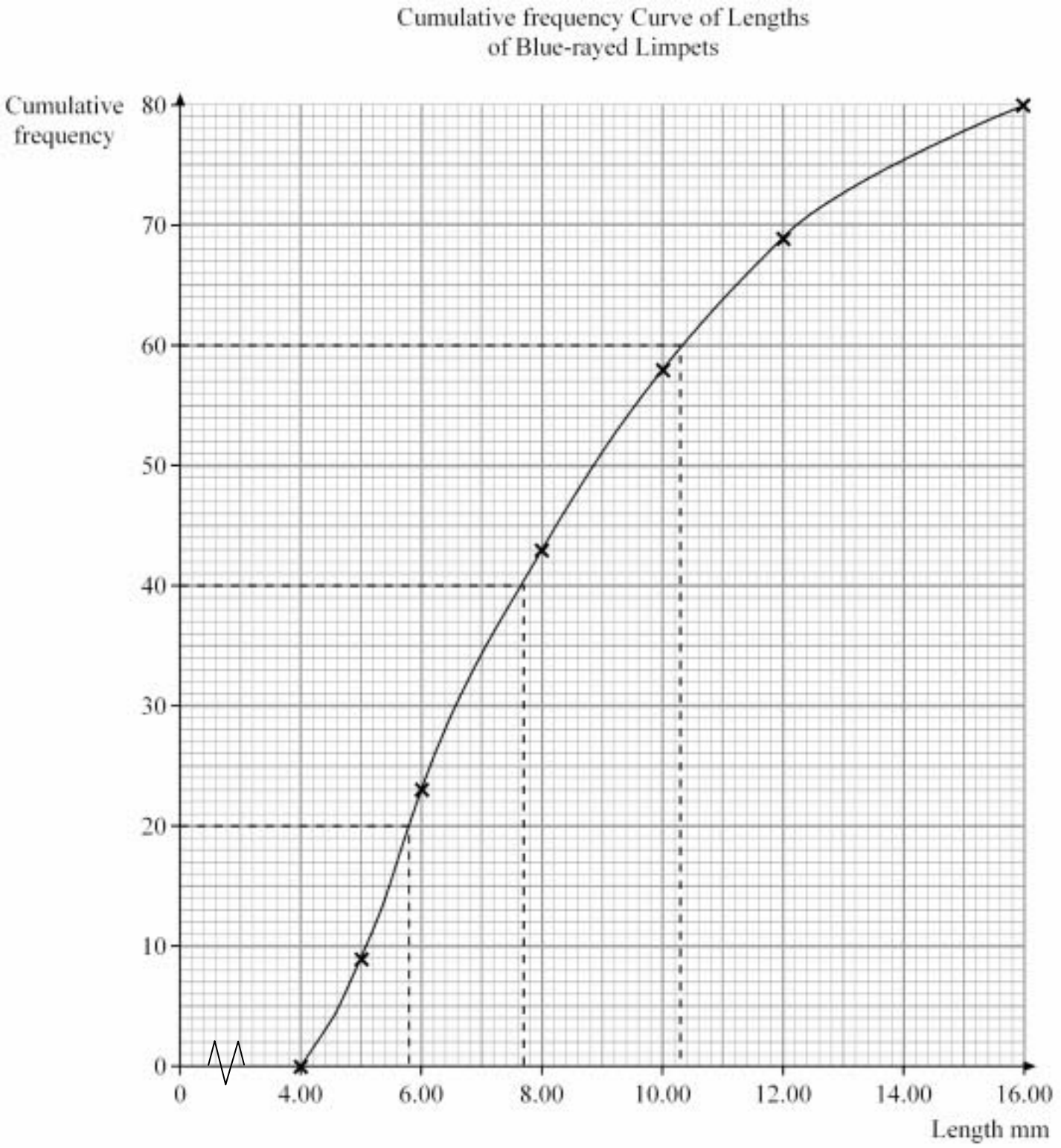
2 or more complete attempts, neither/none crossed out	mark both/all fully and award the mean mark rounded down
1 complete and 1 partial attempt, neither crossed out	award credit for the complete solution only
Crossed out work	do not mark unless it has not been replaced
Alternative solution using a correct or partially correct method	award method and accuracy marks as appropriate

Mathematics and Statistics B Statistics 1 MBS1 January 2005

Question Number and Part	Solution	Marks	Total	Comments
1(a)	0.0	B1		0.0 (–0.2 ~ 0.2)
(b)	–0.8	B1 B1		negative and > –1 magnitude 0.6 ~ 0.98
(c)	–0.8	M1 A1	5	negative and > –1 magnitude 0.4 ~ 0.98
	Total		**5**	
2(a)(i)	P(2 or fewer) = 0.9526	B1		0.953 (0.952 ~ 0.953)
(ii)	P(>1,<3) = P(2) = P(2 or fewer) – P(1 or fewer) = 0.9526 – 0.8088 = 0.144	M1 m1 A1	4	P(2) required P(2 or fewer) – P(1 or fewer) or correct use of formula 0.144 (0.143 ~ 0.1445)
(b)(i)	mean 5 × 0.8 = 4 standard deviation √4 = 2	B1 M1 A1	3	4 cao √their mean - allow variance = their mean - variance must be stated 2 cao
(ii)	P(fewer than 3) = 0.2381	B1	1	(0.2375 ~ 0.2385)
	Total		**8**	
3(a)(i)	Length f cf 4.00 - 9 9 5.00 - 14 23 6.00 - 20 43 8.00 - 15 58 10.00 - 11 69 12.00 - 16.00 11 80 + graph (see next page)	M1 m1 B1 A1	4	method for cumulative frequency cf plotted against ucb scales and labels – must be **cumulative** frequency reasonably accurate plot - by eye Ignore graph below 5 **sc** use of 4.995 for ucb use of 4.95 for ucb – M1m1B1A0
(ii)	median = 7.7 interquartile range 10.3 – 5.8 = 4.5	B1 M1 A1	3	7.7 (7.6 ~ 7.9) needs previous m1 or interpolation method - interpolation and incorrectly plotted graph 4.5 (4.1 ~ 4.8) needs previous m1 or interpolation
(b)	Limpets at second site have shorter shells on average and are less variable.	B1√ B1√	2	ft mean shorter - their median or one comparable ft less variable - their iqr – needs some interpretation e.g ‘average’ / variability
(c)	No information about how data was collected	E1	1	reason
	Total		**10**	

MBS1 (cont)

Graph for Question 3



MBS1 (cont)

Question Number and Part	Solution	Marks	Total	Comments
4(a)(i)	P(female) = 45/75 = 0.6	M1		
(ii)	P(female $\mid$ >8) = 13/20 = 0.65	M1		
(iii)	P(female $\mid$ <3) = 12/20 = 0.6	M1		
		A1	4	acf
(b)	Independent P(female)=P(female $\mid$ <3)	M1		comparison of P(female) with P(female $\mid$ <3) or P(<3) with P(<3 $\mid$ female) or P(female) × P(<3 $\mid$ female) with P(female&<3) orP(<3) × P(female $\mid$ <3) with P(female&<3)
		A1	2	correct conclusion from correct probabilities
(c)	selecting a male teacher	B2,1	2	any mutually exclusive event
(d)(i)	$\frac{12}{75}\times\frac{11}{74}\times\frac{10}{73} = 0.00326$	M1		method- allow with replacement
		A1		0.00326 (0.00325 ~ 0.0033) or $\frac{44}{13505}$ acf
(ii)	$\frac{45}{75}\times\frac{44}{74}\times\frac{43}{73}+\frac{30}{75}\times\frac{29}{74}\times\frac{28}{73} = 0.270$	M1		attempt at P(all female) + P(all male)
		M1		method for P(all female) and P(all male) - allow with replacement
		A1	5	0.270 (0.2695 ~ 0.271) or $\frac{730}{2701}$ acf
	Total		**13**	

MBS1 (cont)

Question Number and Part	Solution	Marks	Total	Comments
5(a)(i)	Binomial $n = 50$ $p = 0.4$	B1		Binomial
	P(20 or fewer) = 0.5610	B1		$n = 50$ $p = 0.4$
		B1	3	0.561 (0.5605 ~ 0.5615)
(ii)	20 or fewer invigorating →30 or more relaxing	M1		reasonable attempt to express in terms of number of relaxing cubes or method for calculating 20 or fewer invigorating
	P(30 or more) = 1 – P(29 or fewer)	m1		P(30 or more) = 1 – P(29 or fewer)
	= 1 – 0.9966			
	= 0.0034	A1	3	0.0034 (0.00335 ~ 0.00345)
(iii)				
	More relaxing →26 or more relaxing	M1		reasonable attempt to express more relaxing in terms of number of relaxing cubes
	P(26 or more) = 1 – P(25 or fewer)			
	= 1 – 0.9427			
	= 0.0573	A1	2	0.0573 (0.057 ~ 0.0574)
(b)(i)	Not binomial, n not fixed	M1		not binomial
		A1		n not fixed
(ii)	Not binomial, p not constant/not independent	M1		not binomial
		A1	4	reason
	Total		**12**	

MBS1 (cont)

Question Number and Part	Solution	Marks	Total	Comments
6(a)(i)	$z = \frac{11-7.5}{2.5} = 1.4$	M1		method for z - ignore sign
		M1		a correct use of normal tables
	P(<11) = 0.919	A1	3	0.919 (0.919 ~ 0.92)
(ii)	$z_1 = \frac{5.5-7.5}{2.5} = -0.8$	M1		method for z's - both signs correct
	$z_2 = \frac{10.5-7.5}{2.5} = 1.2$	M1		correct methods, their z's
	Probability between 5.5 and 10.5 is			
	0.88493 – (1 – 0.78814) = 0.673	m1		completely correct method
		A1	4	0.673 (0.6725 ~ 0.6735) implies full marks
(b)	$7.5 - 1.2816 \times 2.5 = 4.30$	B1		(1.28 ~ 1.29)
		M1		(their z) × 2.5
		m1		completely correct method
		A1	4	4.30 (4.29 ~ 4.3)
(c)	$z = \frac{5.0-7.5}{\frac{2.5}{\sqrt{6}}} = -2.449$	M1		use of $\frac{2.5}{\sqrt{6}}$
		m1		correct method for z
	probability mean less than 5.0			
	= 1 – 0.9928 = 0.0072	m1		completely correct method
		A1	4	0.0072 (0.007 ~ 0.0073)
(d)	Very unlikely for a random sample of employees. Suggests that cleaners live nearer their place of work, on average, than council employees as a whole.	E1√		Unlikely
		E1	2	reason/conclusion
	Total		**17**	

MBS1 (cont)

Question Number and Part	Solution	Marks	Total	Comments
7(a)	see graph on next page	M1 A1	2	method for scatter diagram reasonably accurate plot, by eye, allow one small slip, disallow for joined up points
(b)	$y = 30.3 + 1.70x$	B2 B2		30.3 (30.2 ~ 30.3),allow M1A1 1.70 (1.70 ~ 1.71),allow M1A1
	$x = 0$ $y = 30.3$ $x = 150$ $y = 285.9$	M1 A1	6	method for line accurate line
(c)(i)	5 (120,94) Spent a lot of cash in a relatively short time	B1 E1	2	5 reason/point below line
(ii)	4 (110,330) Spent a small amount of cash in a relatively long time	B1 E1	2	4 reason/point above line
(d)(i)	Estimate of hours per pound spent	E1		
(ii)	Ignoring exceptional points graph is approximately linear, No substantial evidence of change in rate of spending cash.	E1 E1	3	graph approximately linear no evidence of change in rate - needs attempt at a reason.
	Total		**15**	
	TOTAL		**80**	

MBS1 (cont)

Graph for Question 7