GCE 2004
June 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	accuracy
E	mark is for	explanation
√ or ft or F		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

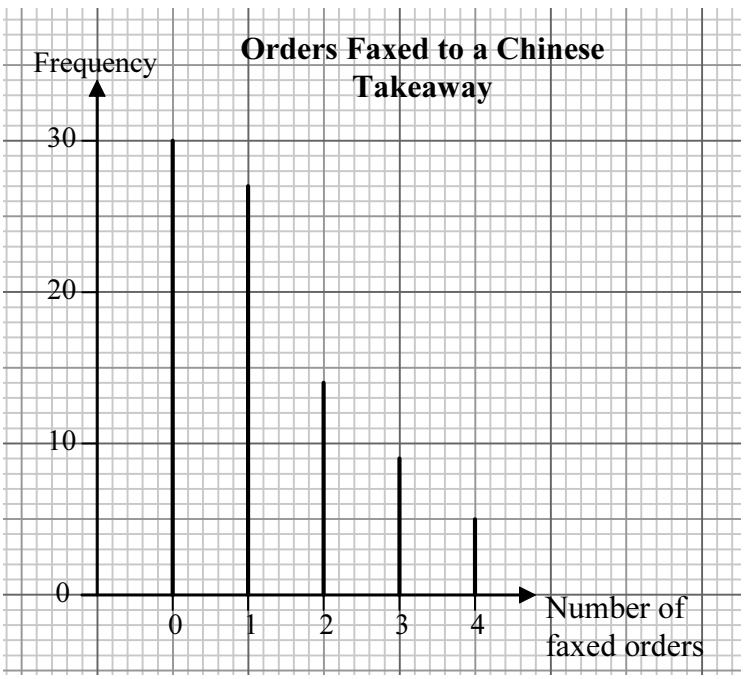
MC – *x*	deducted *x* marks for mis-copy
MR – *x*	deducted *x* marks for mis-read
isw	ignored subsequent working
bod	given benefit of doubt
wr	work replaced by candidate
fb	formulae book

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 June 2004

Question Number and Part	Solution	Marks	Total	Comments
1(a)	Poisson	B1	1	cao
(b)(i)	P(2 or fewer) = 0.570	B1		0.570 (0.569 to 0.57)
(ii)	P(4) = 0.9041 – 0.7787	M1		P(4) = P(4 or fewer) – P (3 or fewer) or correct use of Poisson formula
	= 0.125	A1	3	0.125 (0.125 to 0.126)
(c)(i)	Poisson, mean 12	M1 A1		Poisson, mean 5×2.4 (may be implied) Poisson mean 12 (may be implied)
	P(fewer than 6) = 0.0203	B1		0.0203 (0.02 to 0.021)
(ii)	P(>17) = 1 – 0.9370 = 0.0630	M1 A1	 5	P(>17) = 1 – P(17 or fewer) 0.063 (0.0625 to 0.0635)
	Total		**9**	
2(a)(i)	171	B1		cao ignore units
(ii)	4.1	B1		cao ignore units
(iii)	0.831	B1	3	cao dimensionless, disallow if units included
(b)	Heights of all students in the class	B1 B1	 2	All students in the class Heights
	Total		**5**	

Question Number and Part	Solution	Marks	Total	Comments
3(a)(i)				
	(see above)	M1		Method for line diagram – disallow Histogram, allow bar chart
		B1		Scales and labels
		A1	3	Reasonably accurate plot – by eye Disallow if line for 0 coincides with axis
(ii)	mode 0	B1	1	cao
(iii)	total frequency is 85,	M1		Method
	median is 43rd i.e. 1	A1	2	cao ignore method if answer correct
(b)	median – more representative of data	E1	1	More representative of data – allow mode if plausible reason given
(c)(i)	pie chart	B1		cao
(ii)	Bar chart / line diagram	B1	2	cao
	Total		**9**	

MBS1 (cont)

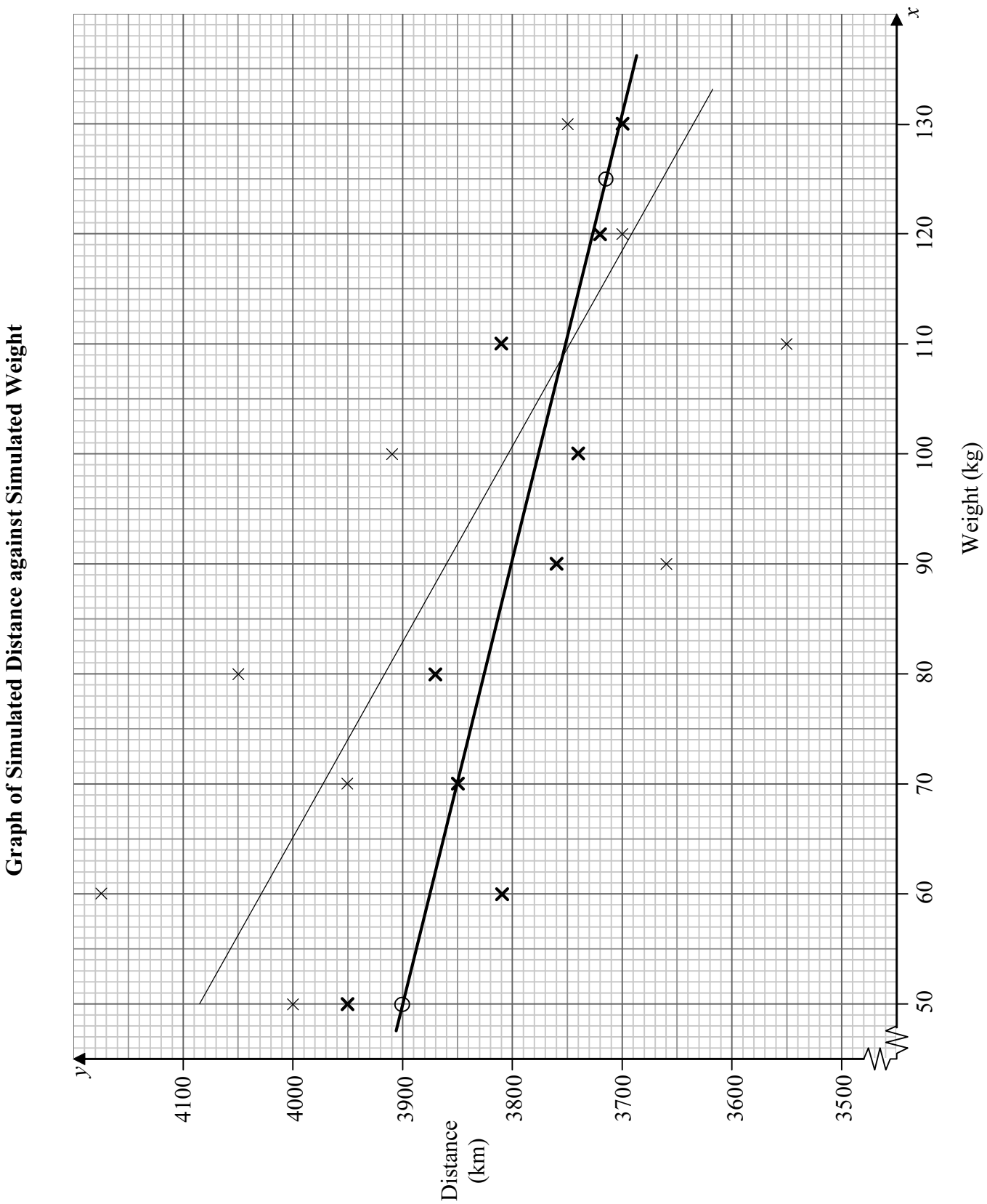
Question Number and Part	Solution	Marks	Total	Comments
4(a)	$z_1 = \frac{3.5-5.0}{1.5} = -1$	M1		Method for z – ignore sign
	$z_2 = \frac{7.25-5.0}{1.5} = 1.5$	m1		Both signs correct or correct diagram
	$P(3.50 < X < 7.25)$	M1		Any correct use of normal tables - generous
	$= 0.93319 - (1 - 0.84134) = 0.775$	m1		Completely correct method – not Dependent on previous m1
		A1	5	0.775 (0.774 to 0.775)
(b)	$z = \frac{4-5}{\frac{1.5}{\sqrt{6}}} = -1.633$	M1		Use of $\frac{1.5}{\sqrt{6}}$
		m1		Correct method for z ignore sign
	P(mean < 4) = 1 – 0.9488 = 0.0512	m1		Completely correct method
		A1	4	0.0512 (0.051 to 0.052)
(c)	To finish before 11.00pm band will need to play 6 pieces in 29 – 5 = 24 minutes i.e. mean 4 minutes. Low probability as shown in (b).	E1		Attempt to find necessary mean, or verify
		E1		Correct mean found
		E1√	3	Correct conclusion, generous
(d)	After playing a long piece the band may choose to play a short piece.	E1	1	Reason
	Total		**13**	
5(a)(i)	$0.2 \times 0.2 = 0.04$	M1		Method
		A1		0.04 cao acf
(ii)	$2 \times 0.2 \times 0.8 = 0.32$	B1		2
		M1		0.2×0.8 used
		A1	5	0.32 cao acf
(b)(i)	$0.65^3 = 0.275$	B1		0.275 (0.274 to 0.275) acf
(ii)	$3 \times 0.2^2 \times 0.8 = 0.096$	B1		3
		M1		$0.2^2 \times 0.8$
		A1		0.096 cao acf
(iii)	$6 \times 0.15 \times 0.65 \times 0.2 = 0.117$	B1		6
		M1		Correct method (allow 3 instead of 6)
		A1	7	0.117 cao acf
	Total		**12**	

MBS1 (cont)

Question Number and Part	Solution	Marks	Total	Comments
6(a)	(see graph on next page)	M1 A1	2	Method Accurate plot by eye, allow one small slip (i.e. within 5×5 square) **sc** Allow M1A0 if 4020 plotted on *y*-axis
(b)	$y = 4020 - 2.47x$	B2		4020 (4000 to 4030)
		B2		–2.47 (–2.46 to –2.47)
	$x = 50 \quad y = 3900$			
	$x = 125 \quad y = 3715$ + line	M1		Method, their line
		A1	6	Accurate line – by eye
(c)(i)	3860	M1		Method – their line
		A1		3860 (3850 to 3870)
(ii)	4000	B1	3	4000 (3999 to 4001)
(d)	Both predictions within observed values so estimates should be reasonable.	E1		Both reasonable
	Vuton residuals quite large – up to 200, Bonti residuals smaller – all < 100, so Bonti prediction likely to be the more accurate.	E1		Bonti likely to be more accurate – must be some comment on variability
		E1	3	Reason
(e)	Both graphs make similar predictions.	E1√		Predictions similar
	Although Bonti prediction likely to be more accurate there is no information as to which is likely to give greater distance.	E1	2	No information which is likely to go further / Bonti preferred more predictable / other sensible comment (depends on Price / if heavier, Vuton etc)
	Total		**16**	

MBS1 (cont)

Graph for Question 6



MBS1 (cont)

Question Number and Part	Solution	Marks	Total	Comments
7(a)(i)	Binomial $n = 5$ $p = 0.15$	B1 B1		Binomial $n = 5$ $p = 0.15$
	P(2 or fewer) = 0.973	B1	3	0.973 (0.973 to 0.974)
(ii)	P(more than 3) = 1 – 0.9978	M1		P(>3) = 1 – P (3 or fewer)
	= 0.0022	A1	2	0.0022(0.00215 to 0.002250) Allow 0.002
(iii)	mean = $5 \times 0.15 = 0.75$	B1		0.75 cao
	s.d = $\sqrt{5} \times 0.15 \times 0.85 = \sqrt{0.6375}$	M1		Method – allow variance if called variance even if incorrect late variance = 0.6375
	= 0.798	A1	3	0.798 (0.798 to 0.8)
				sc Use of $n = 7$ in Q7 7(a)(i) Binomial $n = 7$ $p = 0.15$ 0.9262 3 (ii) 0.0121 2 MR= –1 (iii) 1.05 0.945 3 Total 7 No further allowance in (b) and (c) (if they continue with $n = 7$ this would be a second misread and only (b) (ii) is affected).
(b)(i)	mean = 0.75 s.d = 1.24 or 1.23	B1 B2	3	0.75 cao 1.24 (1.23 to 1.24) allow M1A1 if method shown
(ii)	Proportion = $\frac{0.75}{5} = 0.15$	E1√	1	Their mean divided by 5
(c) (i)	Not plausible s.d. much larger than for binomial	B1 E1√	2	s.d. too large – allow arguments based on probabilities calculated in (a)(i) and (ii)
(ii)	p not constant – some pupils more likely to be late than others late arrivals not independent – may be due to weather/transport difficulties etc	E1 E1	2	p not constant / not independent For 2 marks, need 2 reasons with at least one in context.
	Total		**16**	
	TOTAL		**80**	