

GCE 2004  
*June Series*



## Mark Scheme

### Mathematics and Statistics B *MBS1*

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Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

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*Dr Michael Cresswell Director General*

**Key to Mark Scheme**

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

**Abbreviations used in Marking**

<b>MC – x</b>	deducted x marks for mis-copy
<b>MR – x</b>	deducted x marks for mis-read
<b>isw</b>	ignored subsequent working
<b>bod</b>	given benefit of doubt
<b>wr</b>	work replaced by candidate
<b>fb</b>	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:

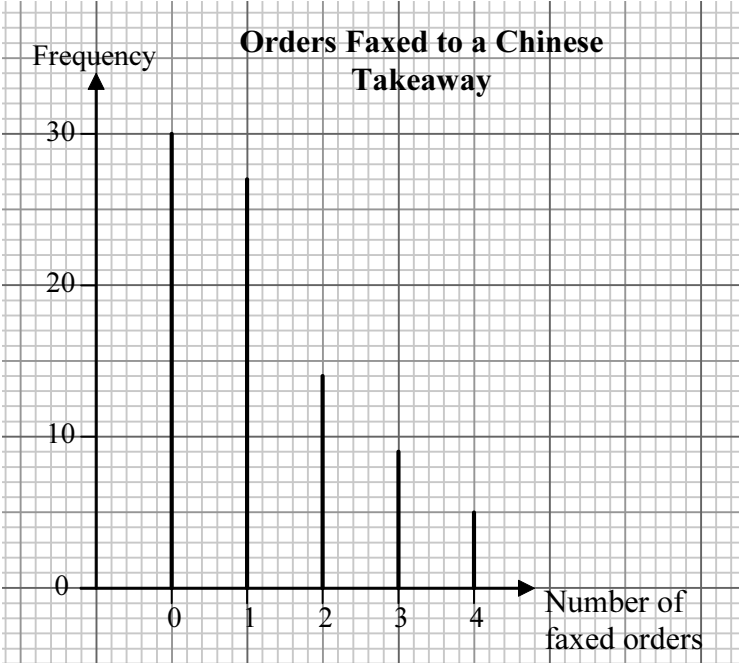
**2 or more complete attempts, neither/none crossed out****mark both/all fully and award the mean mark rounded down****1 complete and 1 partial attempt, neither crossed out****award credit for the complete solution only**

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)	$P(2 \text{ or fewer}) = 0.570$	B1		0.570 (0.569 to 0.57)
(ii)	$P(4) = 0.9041 - 0.7787$  $= 0.125$	M1  A1	3	$P(4) = P(4 \text{ or fewer}) - P(3 \text{ or fewer})$ or correct use of Poisson formula  0.125 (0.125 to 0.126)
(c)(i)	Poisson, mean 12  $P(\text{fewer than } 6) = 0.0203$	M1 A1  B1		Poisson, mean $5 \times 2.4$ (may be implied) Poisson mean 12 (may be implied)  0.0203 (0.02 to 0.021)
(ii)	$P(>17) = 1 - 0.9370 = 0.0630$	M1 A1	5	$P(>17) = 1 - P(17 \text{ or fewer})$ 0.063 (0.0625 to 0.0635)
<b>Total</b>			<b>9</b>	
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
<b>Total</b>			<b>5</b>	

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

## MBS1 (cont)

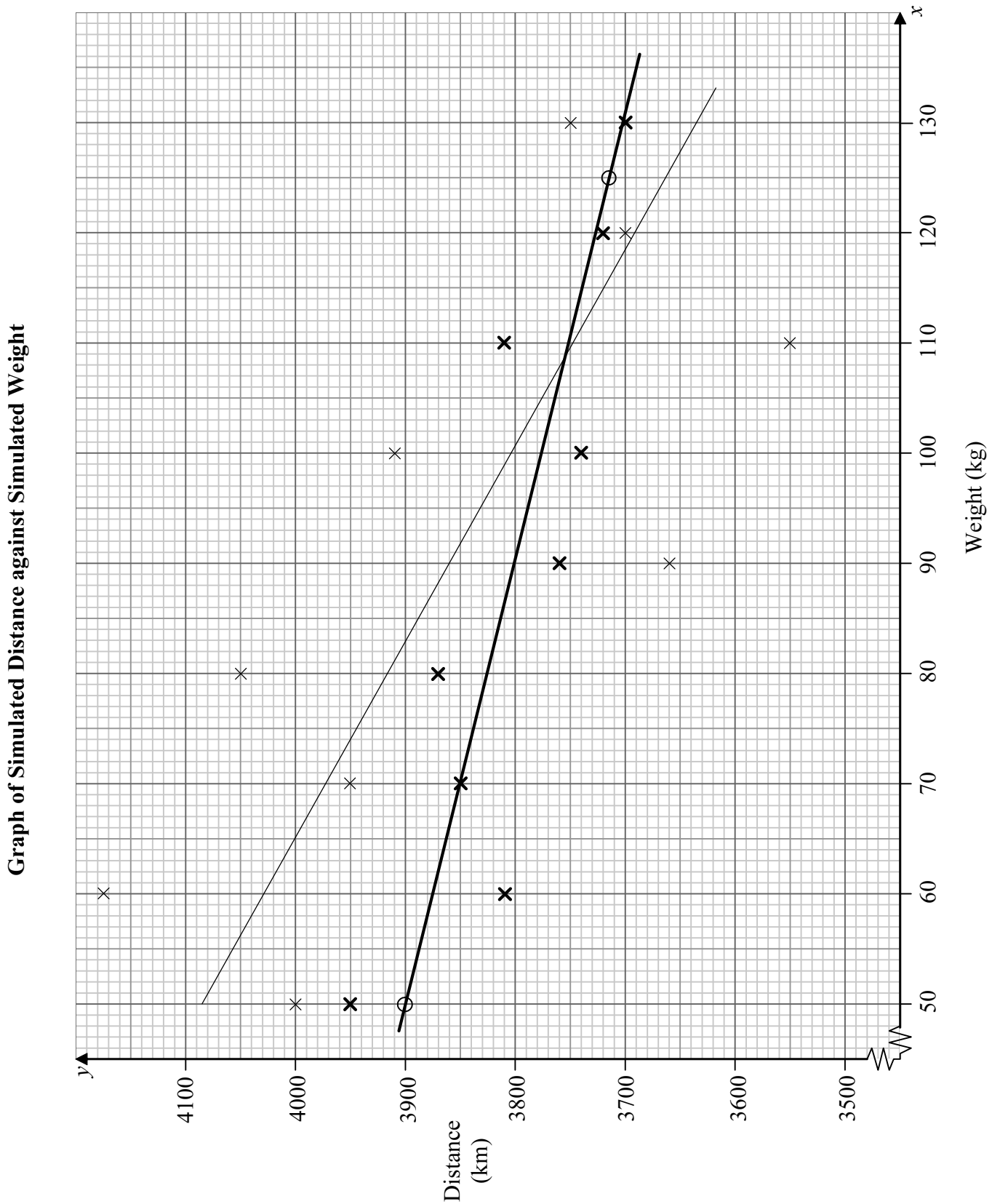
Question Number and Part	Solution	Marks	Total	Comments
4(a)	$z_1 = \frac{3.5 - 5.0}{1.5} = -1$	M1	5	Method for $z$ – ignore sign
	$z_2 = \frac{7.25 - 5.0}{1.5} = 1.5$	m1		Both signs correct or correct diagram
	$P(3.50 < X < 7.25)$	M1		Any correct use of normal tables - generous
	$= 0.93319 - (1 - 0.84134)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

## 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)	$y = 4020 - 2.47x$  $x = 50 \quad y = 3900$ $x = 125 \quad y = 3715$ + line	B2 B2 M1 A1	6	4020 (4000 to 4030) -2.47 (-2.46 to -2.47) Method, their line Accurate line – by eye
(c)(i)	3860	M1 A1		Method – their line 3860 (3850 to 3870)
(ii)	4000	B1	3	4000 (3999 to 4001)
(d)	Both predictions within observed values so estimates should be reasonable.  Vuton residuals quite large – up to 200, Bonti residuals smaller – all < 100, so Bonti prediction likely to be the more accurate.	E1  E1 E1	3	Both reasonable  Bonti likely to be more accurate – must be some comment on variability Reason
(e)	Both graphs make similar predictions. Although Bonti prediction likely to be more accurate there is no information as to which is likely to give greater distance.	E1√ E1	2	Predictions similar  No information which is likely to go further / Bonti preferred more predictable / other sensible comment (depends on Price / if heavier, Vuton etc)
	<b>Total</b>		<b>16</b>	

MBS1 (cont)

Graph for Question 6





## MBS1 (cont)

Question Number and Part	Solution	Marks	Total	Comments
7(a)(i)	Binomial $n = 5$ $p = 0.15$ $P(2 \text{ or fewer}) = 0.973$	B1 B1 B1	3	Binomial $n = 5$ $p = 0.15$ 0.973 (0.973 to 0.974)
(ii)	$P(\text{more than } 3) = 1 - 0.9978$ $= 0.0022$	M1 A1	2	$P(>3) = 1 - P(3 \text{ or fewer})$ 0.0022(0.00215 to 0.002250) Allow 0.002
(iii)	mean = $5 \times 0.15 = 0.75$  s.d = $\sqrt{5} \times 0.15 \times 0.85 = \sqrt{0.6375}$  $= 0.798$	B1 M1 A1	3	0.75 cao  Method – allow variance if called variance even if incorrect late variance = 0.6375  0.798 (0.798 to 0.8)  <b>sc</b> 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 $\checkmark$	1	Their mean divided by 5
(c) (i)	Not plausible s.d. much larger than for binomial	B1 E1 $\checkmark$	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.
	<b>Total</b>		<b>16</b>	
	<b>TOTAL</b>		<b>80</b>	