

GCE 2005
January Series



Mark Scheme

Mathematics and Statistics B *(MBD1)*

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

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 Discrete 1 MBD1 January 2005

Question Number and Part	Solution	Marks	Total	Comments																																				
1(a)	PQ, PT 30, 30 TU 30 ST 35 QR 40 UV 50 Total cost 215p	M1 A1 A1 A1 B1	5	For cao: B2																																				
(b)		M1 A1✓	2																																					
(c)	PQ allowed but QR not. Cheapest alternative to reach R is by SR raising cost by 5p to 220p	M1 A1✓	2																																					
Total			9																																					
2(a)	<table style="border-collapse: collapse; margin-left: 20px;"> <tr> <td style="padding-right: 10px;">A</td> <td style="padding-right: 10px;">B</td> <td style="padding-right: 10px;">C</td> <td>output</td> </tr> <tr><td>0</td><td>0</td><td>0</td><td>1</td></tr> <tr><td>0</td><td>0</td><td>1</td><td>1</td></tr> <tr><td>0</td><td>1</td><td>0</td><td>0</td></tr> <tr><td>0</td><td>1</td><td>1</td><td>0</td></tr> <tr><td>1</td><td>0</td><td>0</td><td>1</td></tr> <tr><td>1</td><td>0</td><td>1</td><td>1</td></tr> <tr><td>1</td><td>1</td><td>0</td><td>1</td></tr> <tr><td>1</td><td>1</td><td>1</td><td>1</td></tr> </table>	A	B	C	output	0	0	0	1	0	0	1	1	0	1	0	0	0	1	1	0	1	0	0	1	1	0	1	1	1	1	0	1	1	1	1	1	B1 B1 B1 B1	4	Two more correct Two more Two more Last one
A	B	C	output																																					
0	0	0	1																																					
0	0	1	1																																					
0	1	0	0																																					
0	1	1	0																																					
1	0	0	1																																					
1	0	1	1																																					
1	1	0	1																																					
1	1	1	1																																					
(b)		M1 A1 A1	3																																					
Total			7																																					

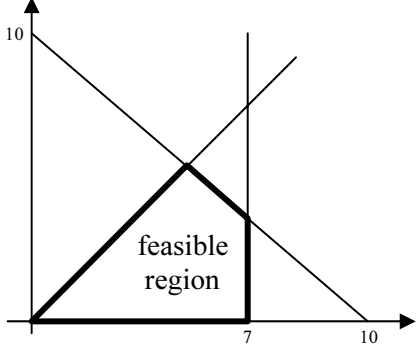
MBD1 (cont)

Question Number and Part	Solution	Marks	Total	Comments
3(a)	<p>A: 0 B: 7 C: 5 D:16, 15, 14 E: 10 F: 20 G: 20, 19 H: 24</p> <p>Trace back to <i>ACEDGH</i></p>	<p>M1 A1 A1 A1</p> <p>M1 A1</p>	<p>6</p>	<p>Two final labels Remaining finals Temporary labels</p>
(b)(i)	24 miles @ 30 mph = 48 minutes	B1	1	
(ii)	<p>New route = $AD @ 60 \text{ mph} + \underbrace{DGH @ 30\text{mph}}_{20 \text{ minutes}}$</p> <p>So first part takes 16 minutes and is 16 miles long.</p>	<p>M1 A1</p> <p>A1</p>	<p>3</p>	
Total			10	
4(a)	<p>$(p \wedge q) \Rightarrow r$ $r \Rightarrow q$ (or $\sim q \Rightarrow \sim r$) $\sim p \Rightarrow \sim r$</p>	<p>M1 A1 M1 A1 M1 A1</p>	<p>6</p>	
(b)	I can buy a car if and only if I am over 17 and have passed my driving test.	M1 A1	2	
(c)	<p>$(p \vee \sim q) \wedge q$ $= (p \wedge q) \vee (\sim q \wedge q)$ $= (p \wedge q) \vee 0$ $= p \wedge q$</p>	<p>M1 A1 A1</p>	<p>3</p>	
Total			11	

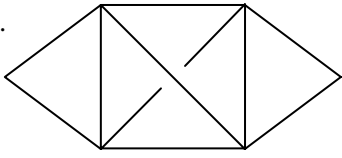
MBD1 (cont)

Question Number and Part	Solution	Marks	Total	Comments
5(a)	A must be completed, so * is C	B1	1	
(b)/(c)		B1 B1 B1 M1 A1✓ M1 A1✓	1 2 4	For D/E For F and G Forward pass (ft their network) Backward pass (ft their network)
(d)	Critical path ADFG Minimum completion time 110 mins	B1 B1	2	
(e)	B, C and E	B1 B1	2	For any two For the third
(f)	First worker: A(0 - 40) D(40 - 60) F(60 - 80) G(80-110) Second worker: B(20-40) E(40-50) C(50-70)	M1 A1 A1	3	
	Total		14	

MBD1 (cont)

Question Number and Part	Solution	Marks	Total	Comments
6(a)	<p>x necklaces a week at one per working day $\Rightarrow 0 \leq x \leq 7$ (similarly for y) y bracelets only follow some of the necklaces, so $y \leq x$ We also need $x + y \leq 10$.</p>	<p>B1 B1 B1</p>	3	
(b)		<p>B1 B1 B1 ✓ B1</p>	4	<p>} One per boundary line (inc ft on third) Region</p>
(c)(i)	<p>Vertices of feasible region are $(0, 0)$, $(5, 5)$, $(7, 3)$ and $(7, 0)$ Income of $20x + 10y$ is maximised at $(7, 3)$ so he should make 7 necklaces and 3 bracelets each week.</p>	<p>M1 A1 A1 B1</p>	4	(or use 'profit line')
(ii)	<p>With the bracelets costing $\pounds B$ we want the maximum of $20x + By$ to be attained at $(5, 5)$. If $B < 20$ then the maximum is attained at $(7, 3)$, but if $B \geq 20$ then the maximum is attained at $(5, 5)$ as required. So must charge at least $\pounds 20$.</p>	<p>M1 A1 M1 A1</p>	4	
Total			15	

MBD1 (cont)

Question Number and Part	Solution	Marks	Total	Comments
7(a)	1	B1	1	(or any sensible discussion or illustration)
(b)	2 e.g. AB and ED	B1 B1	2	
(c)(i)	e.g. add AB Eulerian trail $AEFABCDB$	B1 M1 A1	3	
(ii)	e.g. adding AB twice creates a connected graph with all degrees even	B1	1	
(iii)	4 e.g.	B1		
		M1 A1	3	
(d)(i)	New graph has 13 edges, K_6 has 15	M1 A1	2	
(ii)	If the two missing edges have a common vertex then the graph will contain K_5 . If not it will contain $K_{3,3}$	M1 A1	2	
	Total		14	
	TOTAL		80	