GCE 2005
January Series

ASSESSMENT and QUALIFICATIONS ALLIANCE

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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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

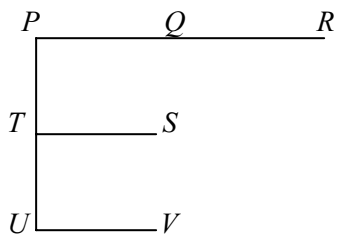
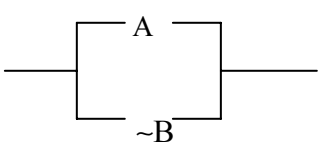
More than one method/choice of solution:

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

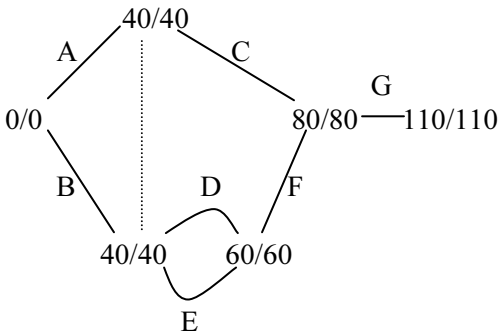
Mathematics and Statistics B Discrete 1 MBD1 January 2005

Question Number and Part	Solution	Marks	Total	Comments
1(a)	*PQ, PT* 30, 30	M1		
	TU 30	A1		
	ST 35	A1		
	QR 40			
	UV 50	A1		
	Total cost 215p	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)	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
(b)		M1 A1 A1	3	
	Total		**7**	

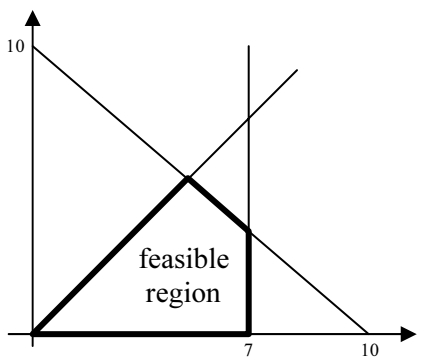
MBD1 (cont)

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

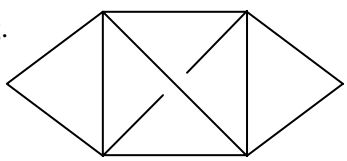
MBD1 (cont)

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

MBD1 (cont)

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

MBD1 (cont)

Question Number and Part	Solution	Marks	Total	Comments
7(a)	1	B1	1	
(b)	2	B1		
	e.g. *AB* and *ED*	B1	2	
(c)(i)	e.g. add *AB*	B1		
	Eulerian trail *AEFABCDB*	M1 A1	3	
(ii)	e.g. adding *AB* twice creates a connected graph with all degrees even	B1	1	
(iii)	4	B1		
	e.g. 	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.	M1		(or any sensible discussion or illustration)
	If not it will contain $K_{3,3}$	A1	2	
	Total		**14**	
	TOTAL		**80**	