GCE 2004
November Series

ASSESSMENT and QUALIFICATIONS ALLIANCE

Mark Scheme

Mathematics and Statistics B
MBD1

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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 mark 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		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

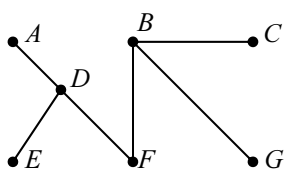
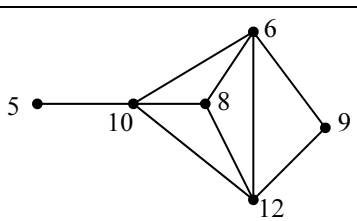
MC –*x*	deducted *x* marks for mis-copy
MR –*x*	deducted *x* marks for mis-read
isw	ignored subsequent working
bod	gave benefit of doubt
wr	work replaced by candidate
fb	formulae book

Application of Mark Scheme

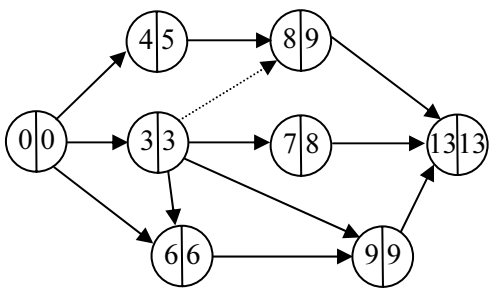
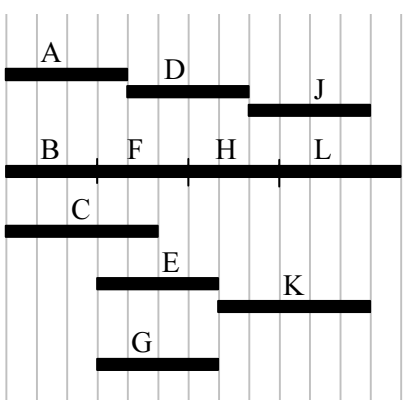
Correct answer without working	**mark as in scheme**
Incorrect answer without working	**zero marks unless specified otherwise**

Award method and accuracy marks as appropriate to an alternative solution using a correct method or partially correct method.

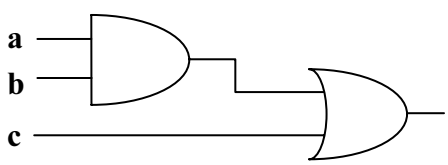
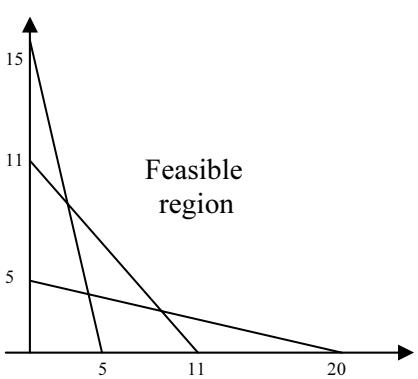
Mathematics and Statistics B Discrete 1 MBD1 November 2004

Question Number and Part	Solution	Marks	Total	Comments
1(a)(i)	*A*: 0			
	B: 15, 12	M1		
	C: 25, 19	A1		Three final labels
	D: 4	A1		Remaining finals
	E: 7 Shortest	A1		Temporary labels
	F: 8 length = 18	B1	5	For 18
	G: 22, 18			
(ii)	Trace back to *ADBG*	M1 A1	2	
(b)	*AD, DF,*	M1 A1		
	DE, FB,	A1		
	BG, BC	A1		
	Total 34 miles	B1	5	
(c)		B1		(omission of labels tolerated)
	A to *G* = 4 + 4 + 7 + 6 = 21	B1	2	
(d)(i)	From (a) (or afresh) the only path *A* to *G* of length less than 20 is *ADBG*	B1	1	
(ii)	Need *BC* to reach *C* in less than 20.	M1		
	Then cheapest links to *E* and *F* are *DE*	A1		
	and *DF*.	A1	3	
	Total		**18**	
2	**p q p⇒q ~p ~(p⇒q) ∧**			
	0 0 1 1 0 0	M1 A1		For implication
	0 1 1 1 0 0			
	1 0 0 0 1 0	M1 A1		
	1 1 1 0 0 0			
	contradiction	A1	5	
	Total		**5**	
3(a)		M1		
		A1		6/8/10/12
		A1		6/9/12
		A1	4	5
(b)	8 (degree 3)	M1 A1	2	
	Total		**6**	

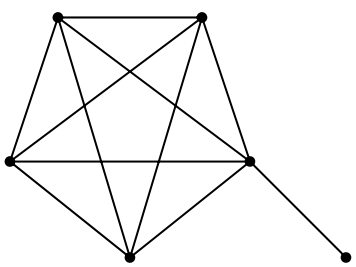
MBD1 (cont)

Question Number and Part	Solution	Marks	Total	Comments
4(a)	A, B, D	B1	1	
(b)		M1 A1 M1 A1	4	Forward pass Backward pass
(c)	Critical path: BFHL Minimum completion: 13 days	B1√ B1√	2	ft sensible answers ft sensible answers
(d)		M1 A1 M1 A1	4	For dealing with critical activities For the rest
(e)(i)	So 9 workers are needed for this schedule.	M1 A1 A1	3	
(ii)	Total days = 97 > 7 × 13, so 7 workers not enough.	M1 A1	2	
(iii)	Delay G by 2 days	B1 B1	2	
	Total		**18**	

MBD1 (cont)

Question Number and Part	Solution	Marks	Total	Comments
5(a)	0 out of last OR $\Rightarrow$ 0/0 into it, so **c** = 0.	M1		
	The second AND gate has a 1 going in and a 0 out, so the other input is 0.	A1		
	So first AND gate has an output of 0.	A1		
	Hence the values giving 0 output are			
	a **b** **c**			
	0 0 0	A1		
	0 1 0	A1	5	
	1 0 0			
(b)	To be equivalent to (a) the circuit must give an output of 1 when we have	M1		
	$(\mathbf{a} \wedge \mathbf{b}) \vee \mathbf{c}$:	A1		
		M1		
		A1	4	
	Total		**9**	
6(a)	x Xtravim give $3x$ mg of vitamin A			
	y Yeasty give y mg of vitamin A			
	Therefore we need $3x + y \geq 15$.	B1		
	Similarly B $\Rightarrow$ $x + 4y \geq 20$.	B1		
	and C $\Rightarrow$ $x + y \geq 11$	B1	3	
(b)		B1√ B1√ B1√		One per line (ft)
		B1	4	Correct region marked
(c)(i)	Vertices of feasible region are	M1		
	(0, 15), (2, 9), (8, 3) and (20, 0)	A1		(or use a cost line)
	Cost of $2x + 5y$ is minimised at (8, 3) so	A1		
	he should take 8 Xtravim and 3 Yeasty each day.	B1	4	
(ii)	The minimum cost is attained at two	M1		
	vertices, one with y-coordinate 0.	A1		
	So the cost line must be parallel to the line from (8, 3) to (20, 0) (i.e. $x + 4y$).	M1		
	So the Xtravim tablets cost one quarter of the Yeasty; i.e. 1.25 p each.	A1	4	
	Total		**15**	

MBD1 (cont)

Question Number and Part	Solution	Marks	Total	Comments
7(a)	Maximum degree = 5, so $d \leq 1$	B1	1	
	Semi-Eulerian for $d = 1$	B1		
	This gives 2 odd degrees – in other case there are > 2 odd vertices.	B1	2	(or $d = 0$ gives an isolated vertex)
	$d = 0$ gives an isolated vertex,	B1		
	$d = 1$ gives a 'dead-end'	B1	2	
(b)		M1 A1		
	Not planar.	B1		
	Contains K_5 as a subgraph.	B1	4	
	Total		**9**	
	TOTAL		**80**	